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ENERGY, FUELS, AND RELATED EQUIPMENT

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TECHNICAL PROGRESS, LABOR SAFETY

Moscow UGOL' in Russian No 9, Sep 77 pp 3-7

[Article by V. P. Fedanov, deputy minister of the USSR Coal Industry]

[Text] The party and government constantly give exceptionally great attention to problems of improving labor safety and accident prevention in all sectors of the national economy of the country and, especially, in the coal industry.

At the 16th congress of trade unions, Comrade L. I. Brezhnev, general secretary of the CC CPSU, spoke of the paramount importance of constant care about improving labor conditions, about reducing manual low-skill and hard physical labor to a minimum, about creating conditions that would eliminate occupational diseases and production accidents. Reequipment of industry is the decisive means for improving labor conditions. From accident prevention to safe equipment -- this is the goal in achieving safe labor conditions at the modern stage of development of our national economy formulated by Comrade L. I. Brezhnev.

The greater attention of the party and government given to labor safety in the coal industry is due to the specific, more complex conditions of labor than in other industries.

Underground coal mining develops under constantly more complex mining-geological conditions. The average annual depth of mining increases by nine meters. While in 1965, it was 320 meters, in 1975 it increased to 410 meters. The number of mines over 600 meters deep is now 230 and many mines operate at a depth of 1000 meters and greater.

As the depth increases, so does the number of seams with unstable side rock structures which are dangerous due to sudden outbursts and mine tremors; the amount of gas in the mine increases, as well as the temperature of the rocks; the tendency of seams to spontaneous combustion, and the danger of fires increase; more dust precipitates; and conditions for maintaining and ventilating the mines become more complicated. The number

of category three mines with respect to gas and the number of extra-category mines have increased in the last 10 years by 1.5 times, while the number of mines susceptible to outbursts doubled.

The USSR Minugleprom [Ministry of the Coal Industry] is taking a number of steps to create safe labor conditions. Their essence is reduced primarily to the use of mechanized machine complexes in underground work that would eliminate injuries to workers by collapsing roof rocks. While in 1970, the ratio of coal mining by means of mechanized complexes was 25 percent of all underground coal mining, in 1976 they mined about 57 percent. The level of mining with mechanized complexes reached 85 to 95 percent in the Moscow, Pechora and Karaganda basins.

The area of application of comprehensive mechanization is being expanded due to seams with complex mining-geological conditions. The volume of mining with mechanized complexes in seams up to 1.2 meters thick increased by 47 times in the last six years. The ANShch machine assembly and KGU mechanized supports were tested and accepted for series production, and an adjustable series of the ADK was manufactured for the steep seams of the Donbass. The AK-3 machine assembly and the KPK equipment complex were tested and accepted for series production for the steep seams of the Kuzbass. Mining coal from comprehensively mechanized stopes in the industry will increase by 33 percent in 1980 as compared to 1976 and its ratio in all underground mining will increase to 64 percent.

Basic directions for developing the USSR national economy in 1976-1980 stressed the importance of strip mining. This method allows using high productivity equipment and provides safe labor conditions for mining. The level of strip mining already exceeds 30 percent and will be about 40 percent of the total coal mining in the country by 1980.

Thus, at present, over 60 percent of the coal in the country is mined by safe methods -- strip mining and by using mechanized complexes and this level will be raised constantly.

The problem of providing labor safety is being solved along with the further development of the industry and an increase in the efficiency of operation of its enterprises. This is facilitated to a considerable degree by improvement in the structure of the mine fund in that when building new mines as well as rebuilding existing ones, the problems of labor safety and accident prevention are solved most fully. In the last 5 years, 29 new large mines were put in operation, 107 old mines were closed, 63 small mines were consolidated and 73 mines were modernized. As a result of improving the management system and reequipping the coal industry, the number of operating coal mining enterprises was reduced by 35 percent. Coal output increased due to the rise in the productivity of labor of shifts while the number of workers decreased.

The USSR Minugleprom is taking steps to expand the volumes of mine building and modernization further, putting capacities in operation and improving their utilization. The policy of building large mines is being followed consistently. The average rated capacity of a mine being put in operation at present is 1.8 million tons per year which is double that of the average capacity of existing mines.

One important condition for raising labor safety in mines is a reduction in the volume of blasting when doing preparatory work because an intensive discharge of gas occurs at the moment of loosening the coal. The amount of mining by means of blasting will decrease to 55 percent in 1980 as compared to 70 percent in 1976.

In 1976, combines were used in about 33 percent of the volume of digging where loading of rocks was required, while in 1980 this indicator will rise to 44 percent. It is planned to create and introduce comprehensive mechanization facilities for various mining-geological conditions using tunneling combines, movable conveyors, installations for creating tie supports and monorail roads. The GPKG combine was accepted for industrial production. It was designed for digging preliminary drifts, as well as mining in wet sloping seams 1.8 to 3.3 meters thick; a tunneling combine was manufactured for the future "Soyuz-19" mine which is being prepared for industrial tests.

By 1976, to reduce accidents in underground transport, almost all mining sections (95 percent) were equipped with conveyors; the length of conveyor lines was increased to almost 3000 km (as against 1960 km in 1966); the level of conveyor transport in horizontal drifts reached almost 20 percent (compared to 10.7 percent in 1966), and about 80 percent (compared to 573. percent in 1966) in sloped drifts used for transporting coal. The number of fully conveyorized mines during the Ninth Five-Year Plan period increased to 80, i.e., doubled. The expansion of conveyorization made it possible to eliminate about 200 cable hauling installations (142 km) including installations with endless cables (about 70 km).

Labor safety can only be provided by accident prevention techniques. Therefore, machines and devices must have operating qualities that would eliminate production accidents and occupational diseases. Tunneling and cutting combines are equipped with dust-removing devices; old design pneumatic drills are being replaced by new ones with vibrations which meet health norms, and remote machine control is used more widely.

To reduce production accidents further, it is necessary to accelerate the developing and organizing of series production of combines with feed systems without chains for seams with slopes up to 35°; drift conveyors with reliable facilities for securing the drive and tension caps, with braking devices and other facilities for reducing to a minimum the overshoot of the chain after the conveyor is switched off; warning signal devices for mining combines operating on steep slopes, tunneling combines, rock loading

machines and drill rigs; combines with remote control, especially, working on seams dangerous with respect to sudden outbursts of coal and gas.

Of exceptionally great importance is reducing the volume of heavy physical labor. In 1976, some 140 kinds of products were manufactured for mechanizing auxiliary processes, and the volume of production of improved mechanization facilities was increased. At stopes of gently sloping seams a changeover was completed from wooden to metal supports, from friction to hydraulic braces which raised considerably the safety of stope supports and the control of roofs.

However, there is still a great number of workers in mines doing heavy manual labor. Securing and controlling roofs at stopes under complex mining-geological conditions still require manual labor. The problem of mechanizing mining and loading coal from niches has still not been solved fully. Especially, cumbersome are processes for maintaining and repairing drifts and hauling roads, and delivering materials and equipment.

The basic directions in eliminating heavy manual labor in the coal industry are the introduction everywhere of progressive technological arrangements, further expansion of comprehensive mechanization and automation of production processes, the creation and introduction of equipment for operations where heavy labor is involved. It is necessary to change over to a technology without the use of niches as less laborious and safer in mining; create mechanized supports at junctions, various hydraulic movers, tractors, etc. All of these problems must be solved in the very near future.

The creation of a normal mine atmosphere for miners which would eliminate methane and coal dust explosions, toxic gas poisoning, and continuous monitoring of its conditions is one of the most important problems in insuring safe labor conditions in mines. In the Ninth Five-Year Plan period, to improve the ventilation of underground mines, ventilation was modernized at 239 mines, and over 440 new high productivity main ventilating fans were put in operation.

The USSR mines use various methods, arrangements and versions for degassing gently sloping, steep, thin and thick coal seams, as well as for pumping out gas from worked out spaces. The efficiency of degassing coal seams in zones of partial unloading of strata is 50 to 60 percent; the efficiency of degassing coal mines done in drifts is 40 percent; and of degassing from worked out space -- 40 to 50 percent.

At present, degassing coal seams and worked out spaces is done at all mines where it is impossible to obtain a safe concentration of methane by ventilation alone. Degassing is done at 180 mines.

At high volumes of gas emission, when degassing cannot reduce the excess of gas in the drifts to the desired level, mining systems are used with ventilation arrangements for diluting methane at the sources of its emission.

In coal mines, reliable monitoring of the methane content in the mine atmosphere, and timely warning of formation of explosive concentrations of methane is very urgent. In recent years, "Sputnik Shakhtera" (SMP-2 and SSh-2) portable methane signal devices were created in the Soviet Union and were introduced in all coal mines. The AMT-3 automatic gas protection system was created and is being introduced widely. When the situation becomes dangerous, it continuously transmits data on the concentration of methane and records it at the dispatcher station. This disconnects the electric feed of the monitored facility, and local and centralized audio and light alarms are given. The AKV-2P apparatus for monitoring the amount of air is used widely in combination with the AMT-3 apparatus for monitoring the ventilation of preparatory drifts. Such systems were introduced at over 150 mines. This made it possible to raise the level of safety considerably. Moreover, the introduction of automatic gas protection makes it possible to economize by intensifying production processes in mines where mining is limited due to the gas factor and due to a reduction in personnel for servicing ventilation sections.

In the very near future, it is planned to create gas protection apparatus for a ventilation dispatcher control system which monitors the amount of air in a section, as well as apparatus for high speed gas protection for mines which are dangerous from the standpoint of sudden outbursts of coal and gas.

The use of high productivity equipment in mines and the increase in the volume of the mined and transported coal increase the formation of dust. Therefore, measures for fighting dust make up a greater ratio of the measures directed to raising work safety in mines.

The changeover to comprehensive dust removal from mines is now basically completed (98 percent of the required number of mines). The mines are considerably better provided with clean water for dust supression (92 percent of the required number of mines). Some 298 mines have installations for cleaning and disinfecting mine waters. Basic types of stope machines are equipped with devices for suppressing dust. Mines are provided with drill rigs, high pressure pumps and other equipment for pumping water into the coal mass, as well as various devices for irrigation and dust removing. The introduction of these facilities to fight dust reduced the amount of dust in the mine air considerably. However, they do not always provide normal labor conditions with respect to the dust factor and, therefore, when necessary, individual protection facilities are used.

To achieve the minimum dust content in the air, research is being done on creating new-in-principle methods for breaking up coal and rocks, and on new methods and equipment for suppressing dust with an efficiency of up to 99-99.5 percent based on modern achievements of the chemistry and physics of solids. Also being developed are reliable methods for dust monitoring and facilities for preventing and healing pneumoconiosis and bronchitis.

With the increase in the depth of mining, the intensity of sudden outbursts of coal, rocks and gas, as well as of mine tremors increases. This presents a direct danger to workers and complicates mining greatly.

The problem of fighting mining tremors in our coal mines was solved to a considerable extent in the last 25 years. While earlier, up to 80 large mine tremors occurred annually, at present, such cases occur only occasionally and only when mining is done which violates existing norm requirements.

The most acute problem is preventing outbursts of coal, rocks and gas. Work on this is being done in accordance with a comprehensive program for 1975-1980 which involves developing a theory for sudden outbursts of coal and gas, methods for forecasting them; creating engineering methods for using protective seams for preventing sudden outbursts; developing new technological arrangements and equipment for safe mining at unprotected dangerous seams; developing methods for regional preventive degassing, pumping water or hydraulic separation; developing methods and equipment for preventing outbursts of rocks and gas, as well as providing for the safety of miners working on seams which are dangerous from the standpoint of sudden outbursts of coal and gas.

In the Ninth Five-Year Plan period, the volume was increased considerably of using such progressive and efficient methods for preventing sudden outbursts of coal and gas as protective finishing off of dangerous seams (by 2.3 times) and pumping water in the loosening mode (by 3.5 times). The introduction of hydraulic squeezing out of the coal seam began to be used more widely. The number of working stopes which were analyzed for dangerous zones increased during the five-year plan period from 88 to 321, and of preparatory stopes -- from 77 to 242.

Great damage is done by mine fires. Fire protection in coal mines improved greatly in the past 10 years. It is sufficient to say that the length of special fire protection pipelines increased from 6800 to 16,600 km with a great number of pipelines having a diameter greater than 100mm. Practically all working positions are now equipped with fire pipelines.

Much work was done on improving the fireproofing of drifts and reducing fire hazards of mining machines and equipment -- the openings of all air supplying drifts and their junctions are secured with nonflammable materials; mines are supplied with a great amount of electric cables with fireproof insulation and fire-resistant conveyor belts; mechanized mining complexes operate primarily on nonflammable emulsions; nonflammable lubrication is used in turboclutches; transformers with dry fillers only are used.

The VGSCh [Militarized mine rescue unit] preventive maintenance service as well as auxiliary mine safety detachments (VGK) played a considerable role in improving fire protection in mines. At present, there are about 600 VGK with over 56,000 people in mines. Since the organization of the VGK (1971), they eliminated in the initial stage (before the arrival of the VGSCh) over 22 percent of underground endogenic fires.

Mine safety sections and mines received new, highly efficient equipment: GIG-4 inert gas generators, types "Temp" and "Monolit" installations for erecting gypsum fire stops; powder fire-extinguishing facilities; automatic installations for extinguishing underground fires, etc. As a result, in the past ten years, the number of fires was reduced by 3.4 times, with more than half of these fires were due to self-ignition and under complex mining-geological conditions.

To reduce high temperatures in deep mines, stationary refrigerators and mobile air conditioners were developed which spanned the entire range of cold requirements of deep mines. At present, ten mines are equipped with stationary refrigerators. To cool working and preparatory stopes, 190 mobile mine air conditioners are used. The comprehensive use of mine equipment for fighting high temperatures and for air conditioning makes it possible to reduce mine air temperature by 5 to 8°.

Simultaneously with solving a complex of technical problems on providing labor safety in mines, steps are being taken to improve the skills of the engineers and technicians and secure skilled workers for the enterprises. Of the total number of engineers and technicians in the industry, 37 percent have higher education and 53 percent secondary special education.

In changing management structure in the coal industry, the labor safety and accident prevention service was strengthened considerably. Ventilation sections were changed to ventilation and accident prevention sections (VTB), which now monitor safe mining. At present, about 15,000 engineers and technicians work in VTB sections. Positions of deputy chief engineers for accident prevention were introduced in mines which are dangerous with respect to gas.

In the complex of measures on labor safety, great importance is given to raising the discipline and responsibility of each member of mine, section and brigade collectives for working without violating the norms and safety rules. All cases of production and technological discipline violations are analyzed weekly at the mines and measures are taken for their eliminations.

The reequipment of the coal industry and the realization of a complex of technical and organization measures on improving conditions of labor and raising labor labor safety made it possible to halve the number of workers doing hard manual labor in the past five-year plan period; reduce production accidents and occupational diseases by 40 percent; reduce the damage and number of underground fires by more than one-third, and the number of sudden outbursts of coal and gas by one-half.

The most important problems of all engineers, technicians and workers in the coal industry in the further improvement of labor safety are raising the personal responsibility of each production manager for creating safe and healthy labor conditions, directing organizational-training work on strengthending discipline and order in production, and creating in the collectives an intolerance toward violators of established working rules and negligent fulfillment of obligations.

Managers of enterprises and organizations must insure absolute fulfillment of the goals of the comprehensive plan for improving the labor safety and health conditions of the USSR Ministry of the Coal Industry in 1976-1980.

It is necessary to study and disseminate more widely advanced experience in operating mines, sections and brigades which achieved considerably improvement in conditions and safety of labor.

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NUCLEAR POWER STATIONS IN ACTIVE SEISMIC AREAS

Moscow ELEKTRICHESKIYE STANTSII in Russian No 11, Nov 77 pp 45-48

/Article by Doctor of Technical Sciences A. P. Kirillov, All-Union Planning, Surveying and Scientific Research Institute imeni S. Ya. Zhuk: "Basic Problems of the Seismic Stability of Nuclear Electric Power Stations"/

/Text/ The assurance of the reliable operation of nuclear power stations, which are being built in the seismically active regions of our country and of their safety for the environment is a complicated task, which differs considerably from similar tasks which arise as applied to civil, industrial and hydraulic structures. A distinctive peculiarity of the problem is the need to ensure not only the strength of the construction structures, which is decisive for other types of structures, but also the reliability of the operating of all the systems of the AES, which are responsible for the failure-proof shut-down cooling of the reactor. Such elements, for example, are the pumping and electrical equipment, the drives of the control and safety rods, the electronic system of monitoring and control and various electrical systems.

As an example there is shown in the figure /not reproduced/ one of the variants of the system of the failure-proof shut-down cooling of a reactor, which ensures by the sequential connection of various circulation loops the reduction of the temperature and radioactivity to a safe level. Each of these loops includes conduits, pumps and electrical equipment, various valves and is served by a complex of electrical and electronic circuits, instruments and units. The failure of any of these elements can lead to the disturbance of the operating capability of the entire system of shut-down cooling.

The systems of shut-down cooling and control of the reactor are located in the construction volumes of AES at different levels by height and in different buildings in the plan. The construction structures, having their own dynamic properties, transform the vibrations of the surface of the earth during an earthquake, which are transmitted to them, so that each structural element, including roofs, will vibrate according to its own law, and these vibrations will be a load for the elements of technological

and electronic equipment and the monitoring and control systems, which have been installed at them.

In order to evaluate the reliability of these systems it is necessary to analyze above all the dynamic properties of the design of the AES, determining as a result of this analysis the law of the vibration process of roofs at all elevations of the installation of equipment. This can be done by both experimental and estimated means, but in both cases the seismic stress transferred to the foundation of the AES should be given in the form of the law of the change of displacements, velocities or accelerations in time, that is, in the form of a seismogram, a velosigram or an accelerogram. In this is another typical feature of an AES, since for another type of structures it is possible to manage by simpler means the representation of seismic influence.

Based on what has been said, the problem of ensuring the seismic stability of AES's reduces to a number of independent problems:

the determination of the characteristics of the seismic activity for the given site, which are given, as a rule, in the form of an estimated accelerogram;

a dynamic analysis of construction structures for determining the spectra of reactions of roofs according to the estimated accelerogram and for evaluating their strength;

a dynamic analysis of the conduits of the first and second loops with an evaluation of their deformability and strength;

an evaluation of the strength of the shell of the reactor and the video control unit according to the spectrum of reaction at the level of its supports;

a dynamic analysis and evaluation of the strength of the containers with liquid, which are in the technological diagram (steam generators, the cooling system of the radioactive zone of the reactor, separators, deaerators and so on);

the evaluation of the strength of the turbo-unit according to the spectrum of the reaction of its foundation;

the evaluation of the strength of the pumping equipment according to the appropriate spectra of reactions;

the evaluation of the strength of the electric power equipment, including electric motors, transformers and others, according to the spectra of reactions;

the evaluation of the operating capability and reliability of the electrical systems, including electrical circuits, wires, switches and others;

the evaluation of the operating capability and reliability of the systems and instruments of control, monitoring and automatic equipment;

the evaluation of the strength of crane equipment;

the evaluation of the strength of the mechanical systems of the transfer of fuel;

the evaluation of the strength and airtightness of various tanks and reservoirs for the storage of radioactive liquids and solid wastes;

the evaluation of the strength of electrical and mechanical systems of emergency feeding;

the evaluation of the strength of the outside elements and systems of the AES, including the cooling pond and the hydraulic structures attached to it, the cooling tower, the pumping station, delivery water mains, the electric power station, the electric power transmission lines and so on.

Unquestionably, the number of problems requiring solution will differ depending on whether it is a question of the safety of the AES or of the continuation of its normal operation during an earthquake. In the former case the main task consists in the shutdown and failure-proof shut-down cooling of the reactor during earthquakes with an intensity greater than the estimated intensity. Only some of the elements of the AES take part in this process. During earthquakes of the estimated intensity or lower the AES should continue to operate, which requires the normal operation of all its elements. It seems expedient to focus attention first of all on the solution of problems of the safety of the AES.

The determination of the characteristics of the seismic activity and the development of a method of predetermining the estimated accelerogram are the most complicated task of all the ones listed. At present the seismic danger of all regions is evaluated according to a point system (the 12-point international system of the Modified Mercalli Intensity Scale is the most widespread), at the basis of which are purely visual evaluations of the consequences of various earthquakes and the nature of the damages to the most widespread types of buildings and structures. The standard characteristics of the intensity of earthquakes are cited below for illustration.

1--no damage;

2--no damage;

3--no damage

4--no damage

5--slight creak of floors and partitions. Rattling of glass. Falling of whitewash. Movement of open doors and windows. In some buildings light damage;

6--light damage in many buildings. Considerable damage in some buildings of groups A and B. In rare instances, in the event of damp ground, thin cracks in roads;

7--in most buildings of group A considerable damage and in some there is destruction. In the majority of buildings of group B there is light damage and in many there is considerable damage. In many buildings of group C there is light damage and in some considerable damage. In some cases there are slides on the steep inclines of road embankments, cracks in roads and ruptures of pipe joints. Damage to stone fences;

8--in many buildings of group A destruction and in some collapse. In the majority of buildings of group B considerable damage and in some destruction. In the majority of buildings of group C light damage and in many considerable damage. Small landslides on the steep inclines of excavations and road embankments. Some cases of the bursting of pipe joints. Monuments and statues move. Stone fences are destroyed;

9--in many buildings of group A collapse. In many buildings of group B destruction and in some collapse. In many buildings of group C considerable damage and in some destruction. In some cases the twisting of railroad rails and damage to road embankments. Many cracks in roads. Rupture and damage of pipes. Monuments and statues topple. Most smokestacks and towers are destroyed;

10--in many buildings of group B collapse. In many buildings of group C destruction and in some collapse. Considerable damage to embankments and dams. Local twisting of railroad rails. Bursting of pipes. Roads receive many cracks and deformations; collapse of smokestacks, towers, monuments and fences;

11--complete destruction of buildings. Destruction of embankments over great distances. Pipes become completely inoperable. Railroad tracks are twisted over a great distance;

12--total destruction of buildings and structures.

In recent times there have been attempts also to ascribe to the points specific numerical characteristics (for example, acceleration). This is a map of the seismic regionalization of the USSR, on which there have been drawn isoseismal lines which divide the territory of the country into regions with the same intensity. Since the intensity of the seismic vulnerability along the surface of the earth depends on the orientation toward the center, geological and topographic conditions, the level of ground waters and so on, this division is quite arbitrary and gives only the most tentative characteristics of the site. More accurate data can be obtained as a result of an additional detailed, comprehensive study of the site with the use of both traditional methods (archeological, geological, geomorphological, geodesic and other surveys) and modern methods (geophysical

surveys, deep seismic sounding, gravimetry, the study of the magnetic field of the earth, space photography and so on). The amount of data obtained as a result of additional surveys makes it possible to evaluate the intensity and configuration of the suspected center and to determine according to existing empirical functions some numerical characteristics of the seismic vulnerability of the surface of the earth (for example, the frequency and duration of vibrations, acceleration).

The estimated accelerogram can be established either in the image of the center and ground conditions with the regions of the earth, for which there are records of strong earthquakes, or according to a different method, a large number of which are now being developed in our country. At the May 1977 session of the International Council on Seismology and Earthquakeproof Construction (MSSSS) attached to the Presidium of the USSR Academy of Sciences the commission for nuclear power stations reviewed several such promising proposals.

Thus, the method of I. V. Riznichenko, which is based on the statistical analysis of the main parameters of seismic activity and the determination of their average values, which conform to the seismic intensity of the given region, makes it possible to obtain spectra of estimated earthquakes. The obtained spectral curves take into account the spectrum of the center, its remoteness and depth and the ground conditions. With its further development this method will make it possible to shift to the construction of an estimated accelerogram.

The method of V. M. Lyatkher also uses the statistical analysis of the parameters of existing recordings of earthquakes of different intensity, as a result of which it is possible to obtain spectra of earthquakes of a differing potential and in the future to shift to the construction of estimated accelerograms.

According to the method of A. G. Nazarov, an album is compiled with a set of typical recordings of accelerograms, from which an analogous one is selected according to the characteristics of the center and the site.

Extremely interesting is the method of Sh. G. Napetvaridze, in which the existing recordings of strong earthquakes of differing intensity are scaled to bedrock, which substantially reduced the differences in the nature of the accelerograms. By having these recordings in a standardized form (all the ordinates are assigned to its maximum value), according to the characteristics of the center and the layers of the earth's crust it is possible to obtain by the numerical method an accelerogram for the surface of the earth, that is, an estimated accelerogram.

The method of V. V. Shteynberg relies on the statistical analysis of existing recordings of earthquakes, the parameters of the center and the ground conditions of the site, that is, on a large number of basic tenets which are also used in other methods.

At the institute of Gidroproyekt [All-Union Planning, Surveying and Scientific Research Institute imeni S. Ya. Zhuk] A. V. Suvilova developed a method which in many ways coincides with the method of V. V. Shteynberg and according to which, depending on the amount of information, an analogous accelerogram can be selected with allowance made for the geological, geophysical, engineering and seismological peculiarities of the site or a set of artificial peculiarities can be selected, the parameters of which are determined with some probability depending on the intensity of the estimated earthquake. This method is already being used for practical purposes and was approved by the commission on the seismic stability of AES's of the MSSSS at the meeting of 20 May 1977.

The evaluation of the reaction of construction structures to seismic activities is carried out, as was already stated, both for the purpose of determining their strength and for determining the nature of their vibrations, if this involves the further evaluation of the operating capability and strength of various equipment and systems. It is possible to solve strictly strength problems, especially at the early stages of designing, by standard methods which have become widespread in rating ordinary industrial and civil structures, which are based on the use either of the classical "static" method or of the more modern correlation method, which makes it possible to take into account the change of seismic forces depending on the dynamic properties of the designs.

The dynamic analysis of the designs and structures of AES's, which are, as a rule, complicated, frequently statically undefined spatial systems, requires the development of special estimate methods using computer programs. At the basis of the developed methods of rating some designs are a large number of assumptions and simplifications, the acceptability of which should be based on experimental and theoretical research. Methods and programs of calculating on the dynamic influences of the protective cover, the foundation under the turbo-unit and the pipes have been developed at the institute of Gidroproyekt. For such complicated structures as the box of the reactor division a method of experimental research using domestic testing equipment has been developed.

The further improvement of already existing methods of calculation and the development of new ones are being continued. Many departments, including the enterprises at which the equipment is being produced, have been recruited for this work. It is necessary above all to develop unified methods of rating equipment for seismic stresses. A number of these methods have already been developed. Thus, the institute of the All-Union Scientific Research, Design and Technological Institute of Hydraulic Machinery jointly with the scientific research sector of Gidroproyekt developed a method of calculation on the seismic tensions of pumping equipment, in which the design of the pump, which is extremely complicated in the mechanical and kinematic respect, is broken down into the simplest elements which yield torating by known methods. The All-Union Scientific Research Institute of Hydraulic Engineering imeni B. Ye. Vedeneyev has developed

methods of rating reservoirs with a liquid and cooling towers. A method of rating the seismic stability of a large amount of technological equipment has been developed and changes have been made in the calculation on the strength of various elements of technological equipment, which take into account the specific nature of the seismic influences.

Unquestionably, the developments need experimental substantiation and further improvement. At the same time, by using them, it is possible right now to carry out quite confidently the development of equipment intended for operation in seismic regions. It should be noted that for a large amount of equipment at present their direct testing for the time being remains the only means of rating the strength and operating capability under the conditions of seismic influences. This pertains above all to various types of electrical equipment, control and measuring instruments and automatic equipment and to their systems.

Taking into account the great diversity and the unitized nature of such equipment, it is necessary above all to elaborate requirements for the dynamic strength and operating capacility for unit instruments and devices, which are produced in series by domestic industry. The dynamic analysis made of the construction structures of AES's, which are the basis for the placement of various types of electrical equipment, control and measuring instruments and automation equipment, makes it possible to establish the range of characteristics of their vibrations by frequencies and accelerations. This in turn makes it possible to elaborate general requirements on all types of electrical equipment and instruments for making sets, which they should satisfy during plant tests.

These requirements reduce to the determination of all the resonance frequencies during testing over the range of frequencies of 0.5-30 Hz. Then a test is made with an acceleration of 3 g for 10-20 sec for each of the determined resonance frequencies. It should be noted that this method coincides completely with the requirements for plant tests of similar equipment, which are customary in Japan and the United States. More complex types of electrical equipment, to which belong items for making sets, for example, electric boards, panels, boxes and so on, should be designed so that their vibrations would not exceed the indicated maximum parameters. The verification of their seismic stability should be made by direct tests on seismic testing units with the obligatory reproduction of all the elements of attachment to the construction structures. The method of such tests was developed at the scientific research sector of Gidroproyekt and was used for evaluating the seismic stability of the electrical equipment of the Armyanskaya AES.

At present the organizations of the Ministry of Power and Electrification with the enlistment of a large number of organizations of other departments on the basis of the consideration of the experience gained in the USSR are preparing a uniform standardized document on designing earthquakeproof AES's, in which both fundamental recommendations and specific instructions on rating the main elements of AES's are set forth.

Taking into account the great responsibility of AES's and the complex nature of the task of ensuring their safety, it is necessary when designing AES's in regions with a higher seismicity to take special measures on increasing the reliability (strength) of construction structures, as well as measures on the selection of the appropriate equipment and its disassembly.

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ELECTRIC POWER DEVELOPMENT

Moscow ELEKTRICHESKIYE STANTSII in Russian No 11, Nov 77 pp 2-21

[Article: "Power Engineering of the Land of Soviets on the 60th Anniversary of Great October"]

[Text] In 1977 all the Soviet people and all progressive mankind of the world are marking an important date--the 60th anniversary of the Great October Socialist Revolution. On 7 November 1917 the workers and peasants of Russia, under the guidance of the Communist Party headed by V. I. Lenin, overthrew the power of the capitalists and landowners, broke the bonds of oppression and created in our country the Soviet State.

The victory of October signified a historical turn in the fate of the peoples of our country, who were the first in the world to start to build a socialist society. Having begun this construction under the most difficult conditions of economic backwardness and a low level of development of productive forces, and having lived through the age of civil war and occupation, the invasion of Hitlerite fascism, which unleased World War II and did enormous harm to our state, as a result of selfless labor the Soviet people carried out the building of a mature socialist society.

"Mature socialism," it is stated in the CC CPSU decree, "On the 60th Anniversary of the Great October Socialist Revolution," "is characterized by the combination of the achievements of the scientific and technical revolution with the advantages of the socialist economic system, the decisive turn toward intensive methods of economic development, a qualitatively new level and scale of production, which make it possible to solve the problems of creating the material and technical base of communism, to ensure the continuous increase of the well-being of the workers and to achieve important successes in the economic competition with capitalism."

Profound changes have occurred in all our society. As L. I. Brezhnev, CC CPSU General Secretary and chairman of the Constitutional Commission, noted in a report on the draft of the Constitution of the Union of Soviet Socialist Republics at the May (1977) CC CPSU Plenum, "The increasing social solidarity of Soviet society serves as the common denominator of all

these changes. The invoilable union of the working class, the kolkhoz peasantry and the national intelligentsia has become even stronger. The differences between the main social groups are gradually disappearing. All the nations and nationalities of our country are being brought closer and closer together by the very course of their life. A new historical community of people--the Soviet nation--has been formed."

In the past 60 years the Soviet Union has been transformed into a leading industrial power, which in the level of industrial production and the generation of electric power occupies first place in Europe and second place in the world. For a large number of the most important types of industrial products (the smelting of pig iron, the extraction of coal, iron ore and petroleum, the production of mineral fertilizers and others) the USSR already occupies first place in the world.

Relying on the achieved successes, the Soviet people under the leadership of the Communist Party are now solving new problems: the creation of the material and technical base of communism, the gradual transformation of socialist social relations into communist ones, the education of people in the spirit of communist consciousness.

Right during the first years of Soviet power V. I. Lenin, the leader of the Communist Party, repeatedly indicated the dominant role of electrification in the solution of cardinal sociopolitical and economic problems and in the creation of a new classless society. "A large-scale machine industry, which is capable also of reorganizing agriculture," said V. I. Lenin, "can be the only material basis of socialism. But it is impossible to confine ourselves to this general tenet. It needs to be defined more concretely. The electrification of the entire country is the large-scale industry, which conforms to the level of the latest technology and is capable of reorganizing agriculture."[1]

Electrification, according to V. I. Lenin, was the most important condition of the increase of the productivity of national labor on the basis of the concentration of production and the socialization of labor and the increase of the technical level of production on the basis of the use of electric power for mechanization and its introduction in technological processes. V. I. Lenin showed that electrification would play an important role in raising the cultural level of the people not only in the city, but also in the countryside, in the elimination of the contrast between them, as well as in the convergence of mental and physical labor.

As if summarizing the role of electrification in solving the socio-economic problems of building communism, V. I. Lenin said: "Communism presumes Soviet power, as a political organ which makes it possible for the mass of

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1. V. I. Lenin, "Poln. sobr. soch." /Complete Collection of Works/, 5th edition, Vol 44, p 9.

oppressed people to execute all matters--without this communism is inconceivable.... The political aspect is ensured by this, but the economic aspect is ensured only when all the threads of the large industrial machine, which is built on the bases of modern technology, and, hence, electrification are concentrated in fact in the Russian proletarian state...."[2]

The highest expression of the views of V. I. Lenin on the role of electrification in the building of a communist society was his famous formula: "Communism is Soviet power plus electrification of the entire country."

In 1917-1918 V. I. Lenin gave the assignment to begin preparing for the building of the first regional electric power stations--the Shaturskaya and Kashirskaya thermal electric power stations and the hydroelectric power station on the Volkhov River near Petrograd. These construction projects were equated with projects of military importance.

The designing of the Nizhegorodskaya, Ivanovo-Voznesenskaya, Kiselovskaya and other thermal electric power stations and the hydroelectric power stations on the Svir', Dnepr, Kura and others was expanded. Commissions on electrification were created locally (in Petrograd, Moscow, the Donbass, in the Urals and others). On 4 March 1919 the Council of People's Commissars adopted a decree on the establishment of the Central Electrical Engineering Council (TsES), which was made up of the most prominent specialists of the electrical building business "for the best and quickest elaboration of technical and estimate questions in the area of new electrical construction."

In April 1918, only five months after the triumph of Great October, V. I. Lenin in "A Draft of a Plan of Scientific and Technical Operations" proposed to give from the Supreme Council of the National Economy a commission to the Academy of Sciences "to organize a number of commissions made up of specialists for the quickest formulation of a plan of reorganization of industry and the economic development of Russia."[3] Right in this work Vladimir Il'ich indicated that special attention should be devoted to electrification.

However, the war unleashed by the counterrevolutionaries and interventionists made it impossible to carry out the assignment of V. I. Lenin during these years.

V. I. Lenin set the task of formulating the first unified plan of national economic development in the history of mankind on the basis of electrification--the famous plan of GOELRO /State Commission for the Electrification of Russia/. The State Commission for the Electrification of Russia, which

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2. Ibid., Vol 42, pp 30-31.

3. Ibid., Vol 36, p 231.

was made up of more than 200 prominent Russian engineers and scientists, was created on his initiative in February 1920.

On 22 December 1920 in a report to the 8th All-Russian Congress of Soviets, in characterizing the plan of GOELRO, V. I. Lenin called it the second party program, the plan of work on the restoration of the entire national economy. He declared from the rostrum of the congress: "Without a plan of electrification we cannot shift to real construction."[4] The 8th All-Russian Congress of Soviets approved the plan of GOELRO, rating it "as the first step of a great economic undertaking."

The Development of USSR Electric Power

The approval by the congress of Lenin's plan of GOELRO played an important role in the electrification of the country. In fulfilling it the Soviet people achieved an increasing rate of development of electric power management of the country.

The construction of new electric power stations and electric power transmission lines was developed throughout the territory of the Soviet Union. Electric power stations were built both in old industrial regions and in the national republics and remote regions of the country.

In 1922 the Kashirskaya GRES, the first electric power station operating on Moscow lignite, was started up, and in December of the same year the Utkina Zavod' (now TETs-5 of Lenenergo [Leningrad Regional Administration of Power System Management]), which operated on peat, was started up. In 1926 the Shterovskaya GRES in the Donbass, which operated on anthracite coal fines, was started up, and in 1926-1927 the Volkhovskaya, Zemo-Avchal'skaya (near Tbilisi), Bozsuyskaya (near Tashkent) and Yerevanskaya hydroelectric power stations were started up.

All this made it possible by 1931--the shortest period for which the plan of GOELRO was designed--to fulfill the assignment on increasing the capacities of electric power stations, and by the final date--1935--to overfulfill all the quantitative outlines of the plan on power engineering and other basic sectors of industry (ferrous and nonferrous metallurgy, the petroleum and coal industries and others). Instead of the 30 electric power stations outlined by the plan of GOELRO, 40 with a total capacity of 4,338,000 kWt were built, which is nearly 2.5 times greater than the outlines of the plan. Soon the Soviet Union occupied third place in the world in the generation of electric power, following the United States and Germany.

The quantitative outlines of the plan of GOELRO were considerably overfulfilled, while its fundamental aims in subsequent years continued to serve

4. Ibid., Vol 42, p 157.

as the general direction of the development of the USSR national economy and its electric power base, they were placed in the current five-year plans of development of the socialist economy.

Beginning in 1930 the construction of heat and electric power stations (TETs's) was expanded, which generated in combination electric and thermal power and centrally supplied heat to industrial enterprises and household consumers. In 1940 the capacity of central heating turbines was 1.4 million kWt, while the generation of thermal power from TETs's alone reached 13.3 million gigacalories.

In 1940 the generation of electric power exceeded 48 billion kWt-hr, while the installed capacity of electric power stations reached 11.2 million kWt.

The power systems of Moscow, Leningrad, the Donbass, Pridneprov'ye, the Urals, Baku, Khar'kov, Uzbekistan, Belorussia, Georgia and others were created. Many power systems assumed a complex nature, having within them condensation, central heating and hydroelectric power stations. All this made it possible to increase the centralization of electric power supply. By the end of 1940 the share of the output of electric power by regional electric power stations increased to 81.2 percent. By this time 20,180 km of electric power transimssion lines with a voltage of 35 kV and more were in operation. In 1940 the first intersystem Dnepr-Donbass 220-kV connection was put into operation.

The further development of electric power management was disrupted by the attack of fascist Germany on the USSR. In the temporarily occupied territory there were the major power systems of the Ukraine, Rostov, Belorussia, the Baltic provinces and in part the western and central regions of Russia. The generation of electric power decreased in 1942 to 29 billion kWt-hr. The fascists destroyed more than 60 large electric power stations with a total capacity of 5.8 million kWt, including the Dneproges imeni V. I. Lenin, the Zuyevskaya, Shterovskaya, Dubrovskaya and other electric power stations. More than 11,000 electric motors, 1,400 turbines and 14,000 boilers were shipped to Germany.

Under the most difficult conditions near the front Soviet power engineers carried out the dismantling of equipment and its evacuation to the rear regions of the country, where in a record time new power capacities were put into operation. During 1942-1944 3.4 million kWt of new capacities were put into operation, mainly at electric power stations located in the Urals, Siberia, Kazakhstan and Central Asia.

During the postwar years the restoration and further development of the electric power management of the country took place at a rapid rate. In 1947 the Soviet Union already occupied second place in the world in the generation of electric power, yielding only to the United States.

During 1945-1958 the capacity of electric power stations increased by 42.5 million kWt, or by 4.8 times, while the generation of electric power

increased by 6.8 times (the average annual growth rate of generations was about 17 percent).

During the period of 1959-1965 the installed capacity of USSR electric power stations increased by more than two times and exceeded 115 million kWt. During this period 220 new electric power stations were put into operation. Of the total introduction of capacities, 79.2 percent fell to thermal electric power stations and 20.8 percent to hydroelectric power stations. The generation of electric power in 1965 reached 506.7 billion kWt-hr, having increased since the last prewar year of 1940 by more than 10 times.

The coefficient of the centralization of electric power generation increased from 67.4 percent in 1932 to 92.8 percent in 1965.

In complete conformity with the legacy of V. I. Lenin, the Communist Party from congress to congress outlined a more and more extensive program of the development of electric power management of the country, indicating the need to develop electric power engineering at an accelerated rate. The most important quantitative assignments of the development of power engineering and the main tasks on the achievement of technical progress were outlined in these decisions.

The decision of the congresses of the Communist Party on the five-year plans served for the workers of power engineering, power machine building and the electrical equipment industry as an urgent program of their activity on the further development of electric power management of the Soviet Union. Table 1 graphically describes the achievements of the Soviet Union in the area of the development of the electric power base.

Table 1

(1) Год	(2) Установленная мощность электростанций, млн. кВт	(3) Производство электроэнергии, млрд. кВт·ч	(1) Год	(2) Установленная мощность электростанций, млн. кВт	(3) Производство электроэнергии, млрд. кВт·ч
1913	1,1	2,0	1955	37,2	170,2
1921	1,2	0,5	1960	66,7	292,3
1925	1,4	2,9	1965	115,0	506,7
1930	2,9	8,4	1970	166,1	740,9
1935	6,9	26,3	1975	217,5	1038,0
1940	11,2	48,3	1976	228,3	1111,6
1945	11,1	43,3	1977 (план) (4)	238,8	1160,0
1950	19,6	91,2			

Key:

1. Year
2. Installed capacity of electric power stations, millions of kWt
3. Generation of electric power, billions of kWt-hr
4. Plan

The main assignments outlined by the Eighth and Ninth Five-Year Plans were overfulfilled. In 10 years, from 1966 through 1975, the installed capacity of electric power stations increased from 115 million kWt to 217.5 million kWt. During this period the average annual increase of the capacity of electric power stations was more than 10 million kWt. The maximum annual introduction of new power capacities at turbine electric power stations during the years of the Eighth Five-Year Plan was 12 million kWt, while during the years of the Ninth Five-Year Plan it was about 13 million kWt. During 1971-1975 44.6 million kWt were introduced at thermal electric power stations, 3.8 million kWt at AES's and 9.1 million kWt at GES's.

During this decade the generation of electric power in the USSR increased from 506.7 billion kWt-hr to 1,038,600,000,000 kWt-hr. The achievement of a level of electric power generation of more than a trillion kWt-hr was an important event in the history of the electrification of our country.

The CPSU Central Committee and the USSR Council of Ministers, in greeting the workers, technicians and employees of power systems, enterprises and organizations and all the power workers of the Soviet Union concerning this achievement in the development of domestic power engineering, wrote: "This great event is a brilliant page in the historical struggle of our party and people in one of the main directions of the building of communism--the campaign for the steady implementation of the great plan of V. I. Lenin on the complete electrification of our country."

In two years of the Tenth Five-Year Plan the assignment of the national economic plan in the area of the generation of electric power is also being overfulfilled. In 1976 1,111,400,000,000 kWt-hr were generated, in 1977 the generation of about 1.16 trillion kWt-hr is anticipated.

The achieved level of electric power generation characterizes not only the quantitative scope of the electrification of the country, but also a qualitatively new stage of the development of Soviet power management.

The main directions of the development of electric power engineering during recent five-year plans were:

1. The concentration of the unit capacity both of electric power stations and of individual power blocks and assemblies.

2. The extensive use of large power blocks which operate at supercritical parameters of steam and yield a savings of specific capital investments and a reduction of the specific consumptions of fuel.

3. The improvement of the quality indicators of operation, the increase of the degree of economy of the operation of power systems, electric power stations, network and repair enterprises.

4. The further development of central heat supply on the basis of the combined production of thermal and electric power. The conversion to the

building of TETs's with a capacity of more than 1 million kWt with the installation of central heating turbo-units with a unit capacity of up to 250 megawatts.

5. A considerable increase of nuclear power. The incorporation of the construction and operation of nuclear electric power stations with a capacity of up to 2 million kWt with reactors with a unit capacity of 440 and 1,000 megawatts.

6. The building of powerful hydroelectric power stations which comprehensively solve questions of electric power engineering, agriculture and other sectors of the national economy. The further shift of the center of water power construction to the regions of Siberia, Central Asia and the Far East.

7. The formation of the USSR Unified Power System, the incorporation of the construction and operation of 750-kV alternating current electric power transmission lines and preparation for the building of 1,150-kV alternating current and 1,500-kV direct current electric power transmission lines.

8. The extensive introduction of automation equipment, remote control and computer equipment for the purposes of increasing the degree of economy and the reliability of electric power supply.

On its 60th anniversary the Soviet Union occupies first place in the world in the maximum capacity of electric power stations. The Krasnoyarskaya GES imeni 50-letiya SSSR with a capacity of 6,000 megawatts, which is the largest in the world, is being successfully operated on the Yeseney. The Bratskaya GES imeni 50-letiya Velikogo Oktyabrya with a capacity of 4,100 megawatts is operating on the Angara. In 1973 the Krivorozhskaya GRES-2 reached a capacity of 3,000 megawatts, while in 1977 the Zaporozhskaya GRES reached a capacity of 3,600 megawatts.

The unit capacities of assemblies and power blocks increased considerably. The most powerful hydraulic turbogenerator units in the world with a rating of 500 megawatts (Krasnoyarskaya GES), 300 megawatts (Nurevskaya GES), 250 megawatts (Bratskaya GES) and others are in operation in the USSR. Thermal power blocks with a unit capacity of 500 and 800 megawatts are being installed.

As a result of the high rate of development of Soviet electric power management, the share of the USSR in the world generation of electric power in increasing with each year. Whereas in 1950 the USSR generated in all 9.2 percent of all the electric power generated in the world, in 1976 this indicato had already reached 16 percent. Now our country alone generates more electric power than such economically developed countries of Europe as the FRG, Great Britain, France, Italy, Sweden and Austria taken together.

Lenin's principle of the uniform, efficient displacement of productive forces and the creation of a developed electric power management both in old industrial regions and in the national republics and remote regions

of the country was consistently pursued during all the years of the development of the electric power engineering of our country.

The rate of development of the electric power base in the national republics--Kazakhstan, Uzbekistan, Tadzhikistan, Turkmenia and Kirgizia, as well as in Moldavia, Belorussia and in the republics of Transcaucasia and the Baltic exceeded the overall growth rate of the generation of electric power in the RSFSR and for the Soviet Union as a whole.

The following data characterize the development of the electric power engineering of the union republics on the 60th anniversary of Great October.

RSFSR

In the size of territory, the size of the population, the reserves of raw material, fuel and power resources, the production volume of industrial products and electric power the Russian Soviet Federated Socialist Republic is first among equals of the fraternal union socialist republics. The generation of electric power in the RSFSR in 1977 will be about 716 billion kWt-hr, or 61.7 percent of the total generation in the country. In the republic many large thermal electric power stations and the largest hydroelectric and nuclear electric power stations have been built, among them are thermal electric power stations with a capacity of more than 2 million kWt--the Troitskaya, Zainskaya, Kostromskaya, Konakovskaya, Kirishskaya, Novocherkasskaya and other GRES's, hydroelectric power stations--the Krasnoyarskaya, Bratskaya, Ust'-Ilimskaya, the cascade of Volga GES's and others, nuclear electric power stations--the Leningradskaya, Novovoronezhskaya, Kurskaya and other AES's. A ramified network of electric power transmission lines of different voltages has been created, including 750-kV alternating current and 800-kV direct current.

The majority of the reserves of fuel and power resources of the republic are located in its eastern regions. Here there are the large deposits of petroleum and natural gas of western Siberia, the Orenburg area and others, the richest reserves of various types of coal of the Kuznetsk, Kansk-Achinsk, Irkutsk, Southern Yakut, Cheremkhovo and other basins.

The achievements in the development of the socialist economy and the creation of the powerful industrial and construction base of the country made it possible during recent five-year plans to develop at an intensified rate the power engineering of the eastern regions of the republic.

The construction of a number of powerful thermal electric power stations which use local kinds of fuel was also carried out. Among them are the Nazarovskaya, Tom'-Usinskaya, Surgutskaya, Belovskaya GRES's and other condensation electric power stations, as well as a number of large heat and electric power stations in the cities and industrial complexes of the eastern part of Russia.

Ukrainian SSR

The republic, in addition to reserves of diverse raw material resources, has reserves of high quality coals in the Donbass, natural gas and petroleum, as well as resources of water power. A powerful electric power system was created on the basis of these fuel and power resources. The generation of electric power in the republic in 1977 will reach about 214 billion kWt-hr and will exceed by more than 2.2 times the production volume in 1965.

The largest thermal electric power stations in the country have been built in the republic--the Zaporozhskaya GRES with a capacity of 3,600 megawatts, as well as the Uglegorskaya, Krivorozhskaya-2, Burshtynskaya, Zmiyevskaya, Pridneprovskaya, Voroshilovgradskaya and other GRES's, the capacity of each of which exceeds 2,000 megawatts. A cascade of hydroelectric power stations has been created on the Dnepr. An extensive system of high-tension electric power transmission lines has been built, which embraces the entire territory of the republic, among them is the latitudinal 750-kV Donbass-Western Ukraine main line.

Belorussian SSR

The rate of development of the electric power engineering of Belorussia, especially during the past 10-15 years, was one of the highest among all the union republics and met the need for power of the rapidly developing industry, municipal services and agriculture.

The generation of electric power in 1977 will reach 30.2 billion kWt-hr, which exceeds by 3.6 times the production volume in 1965. A number of powerful thermal electric power stations--condensation and central heating--have been built in the republic, the largest among them is the Lukoml'skaya GRES, the installed capacity of which has reached 2.4 million kWt.

Uzbek SSR

The republic has considerable reserves of water power resources. The generation of electric power will increase from 11.5 billion kWt-hr in 1965 to 34.4 billion kWt-hr in 1977, or by 3 times. More than 20 multipurpose hydroelectric power stations have been built here. A large share of these GES's are a part of the cascade on the Chirchik River, the largest of which is the Charvakskaya GES with a capacity of 600 megawatts.

Thermal power has undergone considerable development in the republic; to it falls more than 90 percent of the production volume of electric power. A number of large TES's /thermal electric power stations/ have been built, the capacity of which has reached: the Tashkentskaya GRES--1,920 megawatts, the Syrdar'inskaya GRES--1,800 megawatts, the Navoiyskaya GRES--850 megawatts, the Angrenskaya GRES--600 megawatts and others. A large system of electric power transmission lines of different tensions has been built,

among them are the 500-kV lines which connect the power system of Uzbekistan with the power systems of southern Kazakhstan, Kirgizia and Tadzhikistan.

Kazakh SSR

The republic has large reserves of coal. Petroleum and natural gas are produced on the territory of Kazakhstan, the water power economic potential is estimated at 27 billion kWt-hr a year. The coals of the Ekibastuz and Maykyubenskiy basins are the most important types of power fuel for electric power stations as far as reserves and the degree of economy of extraction.

Large-scale and rapidly developing electric power engineering, which occupies third place in the country in production volume, has been created on the basis of the fuel and water power resources in the republic. In 1977 the generation of electric power in the republic is expected to be more than 58 billion kWt-hr, which exceeds the production volume in 1965 by more than 3 times. Thermal electric power stations, the largest of which are the Yermakovskaya GRES with a capacity of 2,400 megawatts and the Dzhambulskaya GRES with a capacity of 1,260 megawatts, yield more than 90 percent of the amount of generated power.

A number of large hydroelectric power stations have been built in the republic: the Bukhtarminskaya (675 megawatts) and Ust'-Kamenogorskaya (330 megawatts) on the Irtysh River and the Kapchagayskaya (434 megawatts) on the Ili River. Electric power transmission lines with a tension of 500 kV unite the power systems of the republic with the power systems of the Urals, Siberia and Central Asia.

Georgian SSR

The republic has an economic potential of water power resources, which is estimated at 32 billion kWt-hr a year. Therefore, since the first years of the implementation of the plan of GOELRO hydroelectric power stations have been intensively built in the republic. Cascades of GES's have been built on the Kura, Khrami, Rioni and other rivers.

Along with hydroelectric power stations, thermal electric power stations--the Tbilisskaya and Tkvarchel'skaya GRES's, and a number of urban and industrial TETs's have been built, the largest of which is the Tbilisskaya GRES with a capacity of 1,280 megawatts. The generation of electric power in 1977 will be nearly 12.5 billion kWt-hr, exceeding the 1965 level by more than 2 times. An extensive network of electric power transmission lines, in particular the 500-kV Inguri GES-Tbilisi line, has been built in the republic.

Azerbaydzhan SSR

The power resources of Azerbaydzhan are represented by petroleum, natural gas and water power. A number of large industrial TETs's and a large

condensation electric power station--the Ali-Bayramlinskaya GRES with a capacity of 1,100 megawatts, have been built in the republic. A number of hydroelectric power stations have also been built on the Kura, Araks, Terter and other rivers, the largest of them is the Mingechaurskaya GES with a capacity of 360 megawatts.

The generation of electric power in 1977 will reach nearly 15.5 billion kWt-hr and will increase as compared with 1965 by 1.5 times.

Lithuanian SSR

The republic has comparatively small resources of power of rivers and peat. The economic potential of water power, which is estimated at 2.8 billion kWt-hr a year, is concentrated mainly in the Neman River.

Hydroelectric and thermal electric power stations, which meet the needs of the national economy for electric and thermal power, have been built in the republic. The largest GES is the Kaunasskaya (Neman River) with a capacity of 90 megawatts, while the largest of the thermal electric power stations is the Litovskaya GRES with a capacity of 1,800 megawatts. The generation of electric power in 1977 is expected to be about 10.5 billion kWt-hr, 2.7 times more than in 1965.

Moldavian SSR

The power resources of the republic are limited to the water power of the Desna and Prut rivers, the economic potential of which is 0.7 billion kWt-hr a year.

In order to supply power to growing cities and industry, thermal electric power stations have been built in Kishinev, Bel'tsy and other cities and the Dubossarskaya GES has been built on the Dnestr. The construction of the Moldavskaya GRES was a powerful stimulus in the development of the electric power engineering of the republic, its installed capacity at present is 2,520 megawatts. The Kishinevskaya TETs-2 is being built.

The generation of electric power will increase from 3.1 billion kWt-hr in 1965 to 13.8 billion kWt-hr is 1977, that is, it will increase by nearly 4.5 times. A ramified system of electric power transmission lines, including with a tension of 110, 220, 330 and 400 kV, has been built; 400-kV electric power transmission lines provide a tie with the power system of Bulgaria.

Latvian SSR

The main power resource of the republic is the Daugava River, on which a cascade of hydroelectric power stations has been built--the Kegumskaya, Plyavin'skaya and Rizhskaya, the largest of which is the Plyavin'skaya GES with a capacity of 825 megawatts. The power system of Latvia also includes a number of heat and electric power stations in Riga, Liyepay and other cities.

In 1977 the electric power stations of the republic will generate more than 3 billion kWt-hr, which exceeds by 2 times the 1965 level of generation. A system of electric power transmission lines ensures the centralized supply of all the rayons of the republic; the highest tension of overhead lines is 330 kV.

Kirgiz SSR

The republic has fuel and power resources, of which about half are water resources, while the other half is coal. The water power potential of the rivers, which is technically possible for utilization, has been determined at 73 billion kWt-hr of annual generation of electric power.

The main resources of water power are concentrated in the Naryn River, where a cascade of large hydroelectric power stations is being built. Here the Uchkurganskaya GES and the Toktogul'skaya GES (1,200 megawatts) have been put into operation and the Kurpsayskaya GES is being built.

Thermal electric power stations are being built, the largest of which is the Frunzenskaya TETs with a capacity of 410 megawatts. The generation of electric power in 1977 will be more than 5 billion kWt-hr, which exceeds the 1965 level by 2.2 times. A 500-kV electric power transmission line was built to connect the power system of Kirgizia with the United Power System of Central Asia.

Tadzhik SSR

The republic has the richest resources of water power, the largest sources of which are the Pyandzh and Vakhsh rivers.

The development of the electric power engineering of the republic is based first of all on the construction of hydroelectric power stations which have a multiple, power and irrigation purpose. In addition to the cascade of GES's on the Varzob River, the Kayrakkumskaya GES on the Syrdar'ya River and the cascade of GES's on the Vakhsh Main Irrigation Canal, the construction of the Nurekskaya GES, the largest in Central Asia, the installed capacity of which has already reached 1,800 megawatts with a planned capacity of 2,700 megawatts, is near completion.

Thermal power engineering is represented mainly by two large TETs, the Dushanbinskaya and Yavanskaya. The generation of electric power, which in 1965 was 1.57 billion kWt-hr, in 1977 will reach more than 7 billion kWt-hr, having increased during these years by nearly 4 times. The feeding of a part of the capacity of the Nurekskaya GES to the United Power System of Central Asia and the connection with it of the power system of Tadzhikistan are being achieved through the 500-kV Nurekskaya GES-Regar-Guzar-Syrdar'inskaya GRES line.

Armenian SSR

The republic has only water power resources, the economic potential of which, being about 6 billion kWt-hr a year, is already being utilized to a considerable extent. Cascades of GES's have been built on the Razdan and Vorotan rivers.

Heat and electric power stations in Yerevan, Razdan and Kirovakan and a large condensation electric power station--the Razdanskaya GRES with a capacity of 1,110 megawatts--have been built in order to meet the needs of the republic for electric and thermal power. In 1976 the first power block of the Armyanskaya AES with a VVER-440 reactor was put into operation. The generation of electric power in 1977 will reach more than 10 billion kWt-hr, which is 3.6 times higher than the 1965 level.

Turkmen SSR

The republic has reserves of natural gas and petroleum. The annual economic potential of water power is estimated at 1.7 billion kWt-hr.

The basis of electric power engineering is thermal electric power stations--the TETs's in Ashkhabad, Krasnovodsk, Chardzhou and other cities and the GRES's in the cities of Mary and Bezmein, the largest of which is the Maryyskaya GRES, the installed capacity of which has reached 800 megawatts. The generation of electric power will increase from 1.4 billion kWt-hr in 1965 to 5.5 billion kWt-hr in 1977, or by 4 times.

Estonian SSR

The fuel resources of the republic are represented by shales, the balance reserves of which are 8.7 billion tons. Two large electric power stations--the Estonskaya GRES with a capacity of 1,600 megawatts and the Pribaltiyskaya GRES with a capacity of 1,435 megawatts--as well as heat and electric power stations in Tallin, Kokhtla-Yarve and other cities have been built on the basis of the reserves of shale.

The generation of electric power in 1977 will reach more than 18 billion kWt-hr and will be nearly 2.6 times greater than in 1965. The power system of Estonia is connected by 330-kV electric power transmission lines with the power systems of Leningrad and Latvia.

The data characterizing the dynamics of the development of the generation of electric power in the union republics during 1965-1977 are presented in Table 2.

The electrification of the union republics was the basis of the increase of the electric power-worker ratio and labor productivity in the republics, the increase of their national income, the building in them of a economy of mature socialism and their further development along the path of the creation

of the material and technical base of a communist society. Thus, on the basis of electrification in the RSFSR in 1966-1975 the electric power-worker ratio increased by 62.6 percent, labor productivity increased by 80 percent and the national income increased by 1.91 times.

Table 2

(1) Союзная республика	(2) Производство электроэнергии, млрд. кВт·ч			
	1965 г.	1970 г.	1975 г.	~ 1977г.*
(3) РСФСР	332,8	470,2	640,0	716,0
(4) Украинская ССР	96,6	137,6	194,6	214,0
(5) Белорусская ССР	8,4	15,1	26,7	30,2
(6) Узбекская ССР	11,5	18,3	33,6	34,4
(7) Казахская ССР	19,2	34,7	52,5	58,3
(8) Грузинская ССР	6,0	9,0	11,6	12,5
(9) Азербайджанская ССР	10,4	12,0	14,7	15,6
(10) Литовская ССР	3,9	7,4	9,0	10,4
(11) Молдавская ССР	3,1	7,6	13,8	13,8
(12) Латвийская ССР	1,5	2,7	2,9	3,2
(13) Киргизская ССР	2,3	3,5	4,4	5,1
(14) Таджикская ССР	1,6	3,2	4,7	7,2
(15) Армянская ССР	2,9	6,1	9,3	10,5
(16) Туркменская ССР	1,4	1,8	4,5	5,6
(17) Эстонская ССР	7,1	11,6	16,7	18,4

*Anticipated indicators.

Key:

1. Union republic
2. Generation of electric power, billions of kWt-hr
3. RSFSR
4. Ukrainian SSR
5. Belorussian SSR
6. Uzbek SSR
7. Kazakh SSR
8. Georgian SSR
9. Azerbaydzhan SSR
10. Lithuanian SSR
11. Moldavian SSR
12. Latvian SSR
13. Kirgiz SSR
14. Tadzhik SSR
15. Armenian SSR
16. Turkmen SSR
17. Estonian SSR

In 1975 in the RSFSR 56 percent of the steel, 52 percent of the chemical fertilizers and 60 percent of the chemical fibers were produced, 84 percent of the petroleum, 54 percent of the coal, 40 percent of the natural gas and 37 percent of the iron ore were extracted. The republic is the main producer of the products of heavy, transport and power machine building and other types of machine building products, as well as agricultural products in the country.

The accelerated development of electric power engineering became one of the main factors of the mighty development of the multisectorial industry and agriculture of the Ukrainian SSR. In 1975 in the republic 53 percent of the iron ore and 31 percent of the coal were extracted, 45 percent of the steel, 30 percent of the steam and hydraulic turbines, 45 percent of the power transformers, 44 percent of the milling equipment, more than 23 percent of the instruments and means of automation and a considerable share of the products of agriculture in the country were produced.

The economy of the Belorussian SSR achieved great successes, especially in the postwar years, owing to electrification. In 1966-1975 alone the electric power-worker ratio in the republic increased by 2.1 times, while the consumption of electric power in agriculture increased by 4.7 times. The republic produces a considerable number of heavy-duty trucks, tractors, computers, machine tools, chemical products, refrigerators, as well as potatoes and products of livestock breeding.

The Kazakh SSR made an enormous leap in its development on the basis of the utilization of rich fuel resources and electrification. The republic is a major producer of nonferrous metals in the country. Kazakhstan occupies third place in the extraction of coal and the production of grain crops and the products of livestock breeding.

The development of the national economy of the Kazakh SSR is one of the vivid examples of the implementation of the Leninist national policy being pursued by the Communist Party of the Soviet Union with respect to the previously backward regions of tsarist Russia. As a result of the implementation of this policy, in a historically short segment of time other union republics--the Baltic provinces, Central Asia, Transcaucasia and Moldavia--achieved great successes in economic development.

Today the Baltic republics--Lithuania, Latvia and Estonia--produce telephone equipment and radio equipment, 30 percent of the railroad passenger cars and 29 percent of the trolley cars, 17 percent of the diesels and diesel generators, 15 percent of the catch of fish and a considerable amount of livestock breeding products fall to them.

In the republics of Central Asia--Uzbekistan, Kirgizia, Tadzhikistan and Turkmenia--the largest production of mineral fertilizers and cotton has been set up and multisectorial machine building, the production of nonferrous metals and the extraction of natural gas and other types of fuel have been developed on the basis of electrification. The republics are a major center of fruit growing and livestock breeding. The achievements in the development of agriculture to a large extent are based on the extensive use of electromechanical irrigation.

The development of the economy of Transcaucasia is based to a considerable extent on the use of the potential of the fuel and water power resources of Georgia, Azerbaydzhan and Armenia. Petroleum, transport and electrical machine building, machine tool building and motor vehicle manufacturing, the production of nonferrous metals, steel and ferroalloys, the extraction of petroleum and gas, petroleum refining and the chemical industry have been developed in the republics of Transcaucasia. Light and the food industries and the production of industrial crops (tea, cotton) and the products of livestock breeding have also achieved a high level of development. The gross production volume of the republics of Transcaucasia in 1975 exceeded the 1960 level by three times.

The Moldavian SSR is a republic with a high level of development of agriculture, especially sheep raising, fruit growing and viticulture, and with a developed industry. The achievements in the economy of Moldavia to a considerable extent are based on electrification, the rates of development of which in recent decades have been the highest as compared with the other union republics.

Electric Power Supply of the National Economy

Electrification is one of the main motive forces of technical progress and the increase of the efficiency of social production and of all sectors of the national economy. The increase of the electric power-worker ratio in industry and agriculture has a direct influence on the growth of labor productivity.

The use of electric power in industry is directly connected with the introduction of the most advanced technology, with the successful solution of the problems of the mechanization and automation of production processes, the development of automated control systems and computer equipment. The electrification of rail and urban transport is one of the most important means of increasing the efficiency of transport and improving the sanitation and hygienic conditions in cities.

The social role of the electrification of daily life in the cities and countryside (the use of electric power in household appliances, radio, television and telephone and so forth) is exceptionally great for the creation of comfortable conditions in apartments, the alleviation of the work of women and the elimination of the differences in urban and rural living conditions.

During all the years of the development of the socialist economy electric power engineering has ensured the uninterrupted supply of electric power and the continuous increase of the consumption of electric power in the national economy.

The data of Table 3 characterize the dynamics of the growth of the consumption of electric power by the sectors of the USSR national economy during 1965-1977.

The main consumer of electric power is industry, in spite of the systematic reduction of its share in the effective consumption for the country, which was caused by the higher growth rate of consumption by agriculture and municipal and personal services. Labor productivity in industry increased during the Eighth Five-Year Plan by 32 percent and during the Ninth Five-Year Plan by 34 percent. According to available estimates about 50 percent of the increase of labor productivity is provided by the increase of the electric power-worker ratio. Today in industry about one-third of the consumption of electric power falls to electrical technological processes.

Table 3

(1) Отрасль народного хозяйства	(2) Потребление, млрд. кВт·ч				(3) Удельный вес, %			
	1965 г.	1970 г.	1975 г.	1977 г.*	1965 г.	1970 г.	1975 г.	1977 г.*
(4) Промышленность	314,2	437,9	588,0	647,2	72,2	69,9	67,0	65,8
(5) Строительство	11,9	15,0	21,0	22,7	2,8	2,4	2,4	2,3
(6) Транспорт	37,1	54,5	74,0	84,0	8,5	8,6	8,45	8,5
(7) Сельское хозяйство	21,1	38,5	74,0	92,5	4,9	6,2	8,45	9,6
(8) Коммунально-бытовые нужды городов	50,6	82,1	119,0	135,5	11,6	12,9	13,7	13,8

*Anticipated indicators.

Key:

1. Sectors of national economy
2. Consumption, billions of kWt-hr
3. Proportion, percent
4. Industry
5. Construction
6. Transportation
7. Agriculture
8. Municipal and everyday needs of cities

Second place in the volume and growth rate of the consumption of electric power is occupied by municipal and everyday services of cities, in which the consumption in apartments is increasing at a higher rate as compared with the public sector. In 1975 56.6 billion kWt-hr, or 222.5 kWt-hr per inhabitant, were expended in cities and rural areas in the consumption of electric power in apartments.

Agriculture occupies third place in the volume and first place in the growth rate of the consumption of electric power. In 1975 the consumption of electric power in agriculture reached 74.0 billion kWt-hr, of them 54 billion kWt-hr were in production and 20 billion kWt-hr were in everyday life.

The electrification of production processes and the increase of the electric power-worker ratio in agriculture are very effective. Each kilowatt-hour used in stable power processes yields in the production of agricultural products a savings on the average of 40 kopecks and 0.3-0.4 man-hr as compared with mechanical drive. This determines the high rate of development of the electrification of agriculture as the most important condition of the solution of the tasks facing agricultural workers on the creation of an abundance of foodstuffs for the population.

A major consumer of electric power--74 billion kWt-hr in 1975--is transportation. The main consumer here is the electrified railroads, the length of which has reached nearly 40,000 km and to which in 1975 fell more than 52 percent of the rail shipments and 58 percent of the total consumption of electric power in transportation. The share of the consumption of electric power by pipeline transportation is continuously increasing. In 1975 it

reached 18.2 percent. The share of the consumption of electric power of electrified urban transport in 1975 was 9 percent.

Thermal Electric Power Stations Are the Basis of USSR Electric Power Engineering

Thermal steam turbine electric power stations, which use certain types of mineral fuel, have been the basis of USSR electric power engineering at all stages of its development.

The data of the increase of the installed capacity and the generation of electric power at USSR thermal electric power stations (including nuclear, diesel and others) are cited in Table 4.

Table 4

(1) Год	(2) Мощность ТЭС		(5) Производство электроэнергии	
	(3) млн. кВт	(4) % мощности всех электростанций	(6) млрд. кВт·ч	(7) % общей выработки
1913	1,13	98,6	2,0	98,3
1921	1,21	98,5	0,51	98,1
1930	2,75	95,5	7,81	93,4
1940	9,61	85,5	43,2	89,4
1945	9,87	88,7	38,4	88,8
1950	16,4	83,6	78,5	86,1
1955	31,3	83,9	147,1	86,4
1960	51,9	77,8	241,3	82,6
1965	92,8	80,7	425,2	83,9
1970	134,8	81,1	616,5	83,2
1975	177,0	81,4	912,6	82,1
1977 (8) (план)	193,4	80,9	1007,0	86,8

Key:

1. Year
2. Capacity of TES's
3. Millions of kWt
4. Percentage of capacity of all electric power stations
5. Generation of electric power
6. Billions of kWt-hr
7. Percentage of the total generation
8. Plan

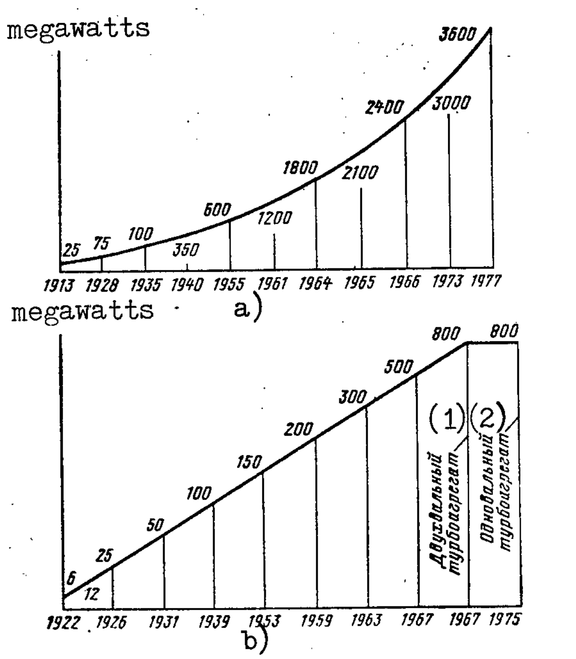
From this table it is evident that USSR heat and power engineering was developed at a fast rate. In 25 years alone, from 1951 through 1975, the installed capacity of TES's increased by 10.5 times, while the generation of electric power by them increased by 11.5 times.

The increase of the capacity and generation of power at thermal electric power stations was especially significant during 1966-1975. During this decade 84.2 million kWt of new capacities were put into operation at TES's, while the growth of the generation of electric power at them was 487.4 billion kWt-hr and increased during this period by more than 2 times.

Technical progress in the development of thermal electric power stations is characterized by the level of concentration of the generation of electric

and thermal power, by the unit capacity of turbines and boilers and by the parameters of the steam being used in the amount of the specific consumptions of fuel for the production of electric and thermal power.

Diagram of the Increase of the Maximum Capacity of Thermal Electric Power Stations (a) and the Unit Capacity of Power Blocks (b)



Key:
1. Twin-shaft turbo-unit
2. Single-shaft turbo-unit

The basis of the concentration of the generation of power is the concentration of its generation at the most powerful KES's [condensation electric power stations] and TETs's, which with the simultaneous increase of the unit capacity of power blocks and the increase of the parameters of the steam being used makes it possible to accelerate substantially the placement of new capacities into operation, to reduce the specific capital expenditures per unit of installed capacity of electric power stations, to reduce the specific consumption of fuel and the production cost of power and to increase labor productivity in construction and operation.

During the years of the building of socialism Soviet heat and power engineering covered the lengthy route from the first regional electric power stations with a capacity of 50-100 megawatts to the largest electric power stations with a capacity of 3,000 megawatts and more. By the end of 1977 Soviet heat and power engineering will have 50 thermal steam turbine electric power stations, each with a capacity of 1,000 megawatts and more. The

total capacity of these electric power stations will be 84.6 billion kWt (49.5 percent of the capacity of all TES's), while the generation of electric power by them will reach about 60 percent of the electric power generated at all the TES's of the country. There will be 19 thermal electric power stations having an installed capacity of 2,000 megawatts and more.

The indicators of the technical progress of Soviet heat and power engineering according to the unit capacity of heat plants and power blocks are very substantial. During the initial period of the fulfillment of the plan of GOELRO units with a capacity of 10,000-16,000 kWt and operating on steam parameters of 18 kg-force/cm^2, 370°C were installed at TES's. In 1930 domestic industry produced the first turbo-units with a capacity of 24,000 kWt, while in 1938 it produced turbo-units with a capacity of 100,000 kWt and operating on steam parameters of 29 kg-force/cm^2, 400°C.

In 1953 the first Soviet condensation power block with a capacity of 150 megawatts was installed at the Cherepetskaya GRES, while during the period of 1958-1965 Soviet power machine builders put into production even more powerful condensation power blocks of 200 and 300 megawatts. All the units with a capacity of 300 megawatts and more are being built for supercritical parameters of steam (240 kg-force/cm^2, 565°C).

The first 500-megawatt power block was put into operation at the Nazarovskaya GRES in 1967, and subsequently blocks of the same capacity operating on a different fuel were put into operation at the Troitskaya GRES. In 1968 an 800-megawatt power block with a twin-shaft turbine was put into pilot operation at the Slavyanskaya GRES, and later blocks of the same capacity, but with a single-shaft turbine, were put into operation at the Slavyanskaya, Zaporozhskaya and Uglegorskaya GRES's. A power block of an even larger capacity--1,200 megawatts--is being installed at the Kostromskaya GRES.

During the period of 1965-1975 the putting of capacities into operation at KES's was carried out mainly by power blocks of 200 and 300 megawatts, the number of which in 1975 reached 249. The data of Table 5 characterize the quantitative increase of power blocks with a unit capacity of 150-800 megawatts from 1960 through 1977.

Table 5

(1) Мощность энерго-блока, МВт	(2) Число установленных энергоблоков				
	1960 г.	1965 г.	1970 г.	1975 г.	1977 г.
150—160	11	60	82	87	88
200—210	1	48	82	117	129
300	—	12	69	132	137
500	—	—	1	2	4
800	—	—	1	4	8
(3) Всего	12	120	235	342	366

Key:

1. Capacity of power block, megawatts
2. Number of installed power blocks
3. Total

The increase of the parameters of the steam of heat engineering equipment provides a substantial reduction of the specific consumptions of fuel on the generation of electric power, which is evident from Table 6.

Table 6

(1) Параметры пара		
(2) Давление, кгс/см²	(3) Температура, °C	(4) Удельный расход топлива, %
29	400	100
90	500	76
130	565	68
240	565	61

Key:

1. Parameters of steam
2. Pressure, kg-force/cm^2
3. Temperature, $^{\circ}$C
4. Specific consumption of fuel, percent

The data of Table 7 characterize the dynamics of the structure of the equipment of TES's according to steam parameters from 1965 through 1975.

Table 7

(1) Параметры пара		(4) Доля суммарной мощности оборудования, %		
(2) Давление, кгс/см²	(3) Температура, °C	1965 г.	1970 г.	1975 г.
240	565	4,45	17,85	26,35
130	565	34,90	38,40	40,90
90	500—535	30,0	24,30	19,85
(5) 35 и ниже	До 425	26,50	16,63	10,84
(6) Прочее оборудование		5,15	2,82	2,06

Key:

1. Parameters of steam
2. Pressure, kg-force/cm^2
3. Temperature, $^{\circ}$C
4. Share of total capacity of equipment, percent
5. 35 and lower
6. Other equipment

These data attest to the sharp increase during the indicated period in the composition of the equipment of TES's of the share of equipment operating on the steam parameters of 130-240 kg-force/cm^2, 565°C.

One of the general directions of the development of Soviet heat and power engineering is central heating, or the combined generation of electric and thermal power at heat and electric power stations, which yields a considerable savings of fuel. The average efficiency of the TETs's operating in the USSR exceeds by approximately 30 percent the efficiency of KES's, and the annual savings of fuel due to this, which is calculated according to the level of generation in 1975, is about 30 million tons in conventional calculations.

In the level of development of central heating and the capacity of TETs's the Soviet Union occupies first place in the world. The total capacity of TETs's in 1975 reached 58.5 million kWt, which is about 34 percent of the capacity of all TES's.

The data on the dynamics of the increase of heat consumption in the country and the sources of heat supply (Table 8) show the continuous increase of the share of TETs's in supplying consumers with heat.

Table 8

(1) Показатель	1965 г.	1970 г.	1975 г.	1980 г. (план) (2)
(3) Все теплопотребление, млн. Гкал	1413	1910	2426	2825
(4) Из них от коллекторов ТЭЦ:				
млн. Гкал (5)	466	700	918	1130
%	32,8	36,6	38,3	40

Key:

1. Indicator
2. Plan
3. All heat consumption, millions of gigacalories
4. Of them from the collecting drums of TETs's
5. Millions of gigacalories

The technical progress of central heating, in addition to the increase of the concentration of the capacity of TETs's, is also characterized by an increase of the unit capacity of central heating plants and blocks, especially in the last 10-15 years. Thus, during the Ninth Five-Year Plan nearly two-thirds of the capacities put into operation at TETs's consisted of units and blocks with a unit capacity of 100 and 250 megawatts

The creation during this period of unique central heating power blocks with a capacity of 250 megawatts operating on steam parameters of 240 kg-force/cm^2, 565°C should be considered a great achievement of Soviet power machine building. The first such central heating block, which at present is series-produced, was installed at TETs No 22 of Mosenergo /Moscow Regional Administration of Power System Management/ during the Ninth Five-Year Plan, and by the end of 1977 their number will reach 9.

The data of Table 9 characterize the dynamics of the reduction of the specific consumptions of conventional fuel for each generated kilowatt-hour and each generated gigacalorie by electric power stations of the USSR Ministry of Power and Electrification.

During the past 40 years the specific consumption of fuel in the generation of electric power was reduced by nearly two times and in the generation of heat by 15 percent, which yielded a great savings of fuel. This savings

for the thermal electric power stations of the USSR Ministry of Power and Electrification during the Ninth Five-Year Plan alone was about 100 million tons of conventional fuel.

The specific consumption of fuel achieved in the Soviet Union for the generation of the electric power released from the collecting bars of electric power stations is presently lower than the analogous indicators of the United States, France, England and some other countries.

Table 9

(1) Год	(2) Удельный расход топлива		(1) Год	(2) Удельный расход топлива	
	(3) г/(кВт·ч)	(4) кг/Гкал		(3) г/(кВт·ч)	(4) кг/Гкал
1940	645	191,1	1970	366	175,6
1950	590	179,3	1975	340	173,6
1960	471	181,2	1977 (план) (5)	334	172,9
1965	414	178,4			

Key:

1. Year
2. Specific consumption of fuel
3. Grams/(kWt-hr)
4. Kilograms/gigacalorie
5. Plan

Technical progress in heat and power engineering is also characterized by the creation of new types of power generating equipment and new technological schemes of the generation of thermal and electric power. In connection with the problem of covering the variable parts of the schedules of loads of power systems, in addition to creating highly maneuverable steam turbines of the condensing type, work is being carried out on the creation of various types of steam-gas plants (PGU's). In 1964 a PGU with a relatively low capacity--16 megawatts--was put into operation at the Leningradskaya GES No 1, while in 1972 a PGU with a capacity of 200 megawatts was built at the Nevinnomysskaya GRES. A PGU with a capacity of 250 megawatts is being installed at the Moldavskaya GRES.

As to strictly gas-turbine plants (GTU's), although a series of highly maneuverable GTU's with a capacity of 100 megawatts has been created in our country, their extensive use at electric power stations is limited, based on the expediency of the more efficient use of natural gas in the national economy.

A promising direction of the development of heat and power engineering is the development of direct (machineless) methods of transforming fuel into electric power, in particular the magnetohydrodynamic (MGD) method. After experimental studies at pilot MGD plants of a small capacity there was built the pilot industrial U-25 plant with a capacity of 25 megawatts, which runs on natural gas.

The continuous operation of the U-25 plant with a capacity close to the estimate--25 megawatts--has been achieved. This makes it possible to begin the development of industrial MGD plants with a large capacity and an efficiency of 55-60 percent.

Labor productivity is an important indicator which characterizes the technical level of heat and power engineering and the level of the organization of the operation of TES's. According to this indicator Soviet heat and power engineering in the past 10-15 years has made substantial gains which are characterized by a considerable reduction of the specific number of industrial personnel engaged directly in production (PPR) per unit of installed capacity of TES's. The dynamics of the improvement of this indicator for the USSR Ministry of Power and Electrification during 1965-1975 is characterized by the data of Table 10.

Table 10

(1) Группа ППР	(2) Удельная численность ППР		
	1965 г.	1970 г.	1975 г.
(3) По отрасли в целом*, чел/1000 кВт	5,46	4,38	3,41
Из них: на ТЭС (4)	3,14	2,16	1,54
(5) на ГЭС	0,67	0,51	0,38
(6) В электросетях, чел/1000 км ВЛ	112	85	75

*With allowance made for the PPR of electric power systems calculated on the equivalence of 100 conventional units of electric power systems to 1,000 kWt of capacity of electric power stations.

Key:

1. Group of PPR
2. Specific number of PPR
3. For the sector as a whole,* people/1,000 kWt
4. Of them: at TES's
5. At GES's
6. In electric power systems, people/1,000 km of overhead lines

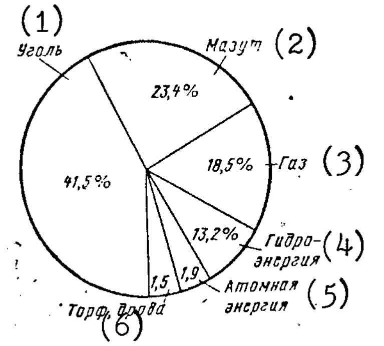
The efficiency of the use of fixed production capital and the level of the organization of the operation are characterized also by the number of hours of use of the installed capacity of thermal electric power stations, which according to the plan in 1977 should reach 5,655 hours a year.

Fuel Supply of Electric Power Stations

In 1977 thermal electric power stations will consume in the generation of electric and thermal power more than 460 million tons of conventional fuel, or about 28 percent of all the fuel extracted in the country.

The Soviet Union is the only major industrial country is the world which bases its economic development on its own fuel and power resources.

Structure of the Generation of Electric Power According to the Types of Power Resources by the Electric Power Stations of the USSR Ministry of Power and Electrification in 1976



Key:

1. Coal
2. Fuel oil
3. Gas
4. Water power
5. Nuclear power
6. Peat, wood

The main principles of the fuel supply of thermal electric power stations were laid in Lenin's plan of GOELRO, which stipulated the need to burn low-grade fuels at electric power stations. This basic tenet was reaffirmed in the decisions of the 25th CPSU Congress, which set the task of the further improvement of the structure of the fuel and power balance and the improvement of the use of fuel and secondary power resources.

The implementation of these decisions was also reflected in the plan of the development of power engineering for the Tenth Five-Year Plan, which provides for the reduction of the construction of TES's operating on liquid and gaseous fuel and the expansion of the construction of those which operate on solid types of fuel. In contrast to the structure of the fuel consumption of thermal electric power stations in preceding years, the share of the consumption of solid types of fuel during the Tenth Five-Year Plan not only will not decrease, but will even increase slightly on the basis of the corresponding reduction of the share of liquid and gaseous fuel (Table 11).

Table 11

(1) Вид топлива	(2) Структура потребления по ТЭС Минэнерго СССР, %			
	1965 г.	1970 г.	1975 г.	1980 г. (план) (3)
(4) Уголь и другое твердое топливо	66,4	50,5	48,4	50,1
Жидкое топливо (5)	11,5	28,8	29,5	28,2
(6) Газ	22,1	20,7	22,1	21,7

/Key on following page/

Key:

1. Type of fuel
2. Structure of consumption for TES's of the USSR Ministry of Power and Electrification, percent
3. Plan
4. Coal and other solid fuel
5. Liquid fuel
6. Gas

Construction of Thermal Electric Power Stations

The growth rate and technical progress of Soviet heat and power engineering are based on the development and technical progress of domestic power and electrical machine building and apparatus building, but are also connected directly with progress in the building of TES's--in designing and the methods of construction, in the organization and mechanization of construction operations.

In the progress of the construction of thermal electric power stations it is possible to trace a number of successive stages which are characterized by the use of improved plans of construction designs and groupings of technological equipment; the shift from individual plans to standard and universal plans of large condensation and central heating electric power stations, which provide for the extensive use of prefabricated metal and reinforced concrete structures, highly productive construction and installation mechanisms and machinery, flow-line and combined methods of construction and installation operations, the block installation of equipment and so forth, as well as by the improvement of the organization of construction and the organization of the management of construction, in particular the extensive participation in construction of specialized construction and installation organizations, the use in the management of construction of methods of network planning and administration.

The creation in power construction of a powerful production base, the increase of the degree of equipment of construction and installation organizations with machinery and mechanisms, as well as the increase of the capital-labor ratio and machine-worker ratio of construction and installation workers were of great importance. The capital-labor ratio per worker by the end of 1975 reached 5,000 rubles, while the machine-worker ratio reached 3,300 rubles, which is 55 percent more than in 1970. Utilizing the existing bases of the construction industry and the available park of construction machinery and mechanisms, during the Ninth Five-Year Plan the power construction workers performed a considerable amount of work, which is calculated for earth-moving operations at 1.6 billion m^3, rock excavation--40 million m^3, monolithic concrete and reinforced concrete--28 million m^3, precast reinforced concrete--38 million m^3, metal designs and water lines--4.4 million tons, technological equipment and pipelines--several million tons.

In 1971-1975 labor productivity in power construction increased by more than 30 percent, the construction of power projects was considerably accelerated, the labor expenditures per kWt of introduced capacity were reduced to 4 man-days.

Nuclear Power Engineering

The Soviet Union is the homeland of nuclear electric power stations. In July 1954 the first nuclear electric power station in the world (near Obninsk) with a capacity of 5,000 kWt was put into operation in our country.

The fact of the use at this electric power station of the energy of nuclear fission for obtaining electric power marked the beginning of a new era in the development of all world power engineering. The 10-15 years following the start-up of this AES in the Soviet Union and throughout the world was a period of intensive scientific research, experimental design and experimental work on pilot industrial models of various types of reactors and other technological equipment of AES's, which confirmed the reliability, radiation safety and good technical and economic indicators of nuclear electric power stations and opened the way for their extensive construction.

In 1964 at the Novovoronezhskaya AES the first block with a water-moderated water-cooled reactor of the VVER /water-moderated water-cooled power reactor/ type with an electric capacity of 210 megawatts was put into pilot industrial operation at the same time as the putting into operation at the Beloyarskaya AES of the first block with a capacity of 100 megawatts.

Through the improvement of the core the capacity of the second reactor of the Novovoronezhskaya AES was increased with the same dimensions of the vessel as in the first reactor to 365 megawatts, while that of the third reactor, which was started up in 1971, was increased to 440 megawatts. This block of the VVER-440 became series-produced and was used in the designs of a number of AES's of the Soviet Union (Kol'skaya, Armyanskaya) and foreign countries (Nord in the GDR, Kozlodoy in Bulgaria, Bogunici in the CSSR, Lovisa in Finland), which are being built with USSR technical assistance.

In 1974 the first power block with a channel water-graphite reactor of the RBMK-1000 type with an electric capacity of 1 million kWt was put into operation at the Leningradskaya AES, while at the end of 1975 the second block of the same type was put into operation here. During this period the Bilibinskaya AES with a capacity of 48 megawatts (four blocks of 12 megawatts each) with water-graphite reactors of the water boiler type and with central heating turbines, which in essence is a nuclear TETs, began operating on the Chukotskiy Peninsula.

The reactors of all the named AES's are slow (thermal) reactors. In July 1973 a BN-350 fast reactor was put into operation at the Shevchenkovskaya AES. The development of AES's with fast reactors is the most important prospect of nuclear power engineering, since it increases by many times (10-15 times) the possibility of using natural uranium as compared with slow reactors.

In addition to a unit with a capacity of 150 megawatts, a plant for the desalinization of sea water with a daily productivity of 120,000 m^3, the steam for which comes from the turbines of the AES, also belongs to the complex of the Shevchenkovskaya AES. In essence the Shevchenkovskaya AES is also a nuclear TETs.

In 1976 the first block of the Kurskaya AES with an RBMK-1000 reactor was put into operation, while in 1977 the first similar block was put into operation at the Chernobyl'skaya AES.

In addition to the Leningradskaya, Kurskaya, Chernobyl'skaya, Armyanskaya and other AES's, which continue to be built and have already been partially put into operation, there is also being expanded the construction of the Smolenskaya, Kalininskaya, Rovenskaya, Southern Ukraine and other new AES's, the introduction of the capacities of which will be carried out in 1978 and subsequent years.

The experience of the construction and operation of AES's has confirmed the reliability of their operation, the radiation safety and the low production cost of the power being generated. Thus, the annual utilization of the installed capacity of the Novovoronezhskaya AES in 1974-1976 was 6,300-6,600 hours, and the production cost of one generated kilowatt-hour in 1975 was 0.641 kopeck, while at the Krivorozhskaya GRES with a capacity of 3,000 megawatts, which runs on Donetsk coal, it was 0.895 kopeck and at the Konakovskaya GRES with a capacity of 2,400 megawatts, which runs on gas and fuel oil, it was 0.712 kopeck. The planned production cost of electric power at the AES's being put into operation in 1976-1980 is even lower--0.48-0.60 kopeck/(kWt-hr).

A list of the operating AES's at the end of 1977 with an indication of their installed and planned capacity is cited in Table 12.

Table 12

(1) АЭС	(2) Электрическая мощность, МВт	
	(3) На 31/XII 1977 г.	(4) Проектная
Нововоронежская (5)	1455	2455
Ленинградская (6)	2000	4000
Курская (7)	1000	4000
Чернобыльская (8)	1000	4000
Кольская (9)	880	1760
Армянская (10)	407	814
Белоярская (11)	300	900
Шевченковская (12)	150	150
Мелекесская (13)	72	72
Билибинская (14)	48	48
Обнинская (15)	5	5

Key:
1. AES's
2. Electric capacity, megawatts
3. On 31 December 1977
4. Planned
5. Novovoronezhskaya
6. Leningradskaya

/Key continued on following page/

Key:

7. Kurskaya
8. Chernobyl'skaya
9. Kol'skaya
10. Armyanskaya
11. Beloyarskaya
12. Shevchenskovskaya
13. Melekesskaya
14. Bilibinskaya
15. Obninskaya

Hydroelectric Power Stations

During the years of Soviet power the water power of our country has achieved considerable development.

Of the 30 regional electric power stations outlined by the plan of GOELRO, 10 electric power stations with a total capacity of 640,000 kWt were hydroelectric power stations, the largest of which is the Dneprovskaya GES. The plan of GOELRO was overfulfilled and in 1935 11 GES's with a capacity of 771,000 kWt were in operation.

By 1939 in various regions of the country 33 bydroelectric power stations had already been built and the construction of new GES's, particularly the GES's of the Volga cascade, was extensively developed.

The principles of the cascade nature and complete utilization of the runoffs of rivers, which are at the basis of Soviet water power, were implemented in the construction of GES's.

At the end of the 1940's the construction of the largest GES's on the Volga, in the regions of Kuybyshev and Volgograd was begun, while in the second half of the 1950's the extensive development of the water power resources of the eastern part of the country and especially of Siberia was begun, where the largest reserves of water power are concentrated.

At the end of 1955 the first unit of the Volzhskaya GES imeni V. I. Lenin, which achieved the planned capacity of 2,300 megawatts in 1957, was put into operation, while in 1958 the even larger Volzhskaya GES imeni XXII s"yezda KPSS, which in 1962 reached the capacity of 2,530 megawatts, was put into operation. Both of these GES's were at the time the largest hydroelectric power stations in the world. During the same period the Kremenchugskaya and Dneprodzerzhinskaya GES's were put into operation on the Dnepr cascade.

The most important events in the development of water power were the start-up in 1961 of the Bratskaya GES, which in 1967 reached the planned capacity of 4,100 megawatts, and the start-up in 1967 of the Krasnoyarskaya GES, which in 1973 reached the planned capacity of 6,000 megawatts.

Cascades of hydroelectric power stations and individual large GES's were built in practically all the union republics. A large number of new hydroelectric power stations, which have already been partially put into

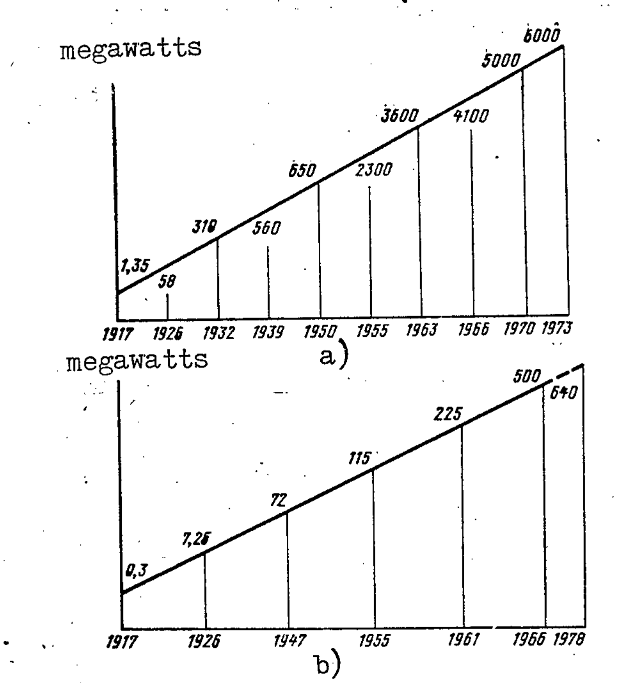
operation or the start-up of which will be carried out in the immediate years to come, are under construction. Among them is the most powerful GES of the country--the Sayano-Shushenskaya GES, the first unit of which with a capacity of 640 megawatts will be put into operation in 1978.

Pumped-storage electric power stations (GAES's) are being built in order to cover the peaks and reduce the dips of the loads of power systems. In 1972 the first GAES in the USSR, the Kievskaya GAES, was brought to the full capacity of 225 megawatts. The Zagorskaya GAES (near Moscow) with a capacity of 1,200 megawatts is being built and during the Tenth Five-Year Plan the construction of the Kayshyadorskaya GAES on the Neman River with a capacity of 1,600 megawatts will begin.

In 1977 the total installed capacity of all GES's will reach 43.6 million kWt, while the annual generation of electric power will reach 158.4 billion kWt-hr, which is 18.2 percent of the capacity of all electric power stations and 13.7 percent of the total generation of electric power in the country.

Soviet water power has gained leading positions in the world not only according to the maximum capacity of hydroelectric power stations, but also according to the methods of water power construction. In the USSR the construction of GES's has been developed under the most diverse geological conditions (on sands, clays, compressable loams, sandy loams, permafrost and so on), as well as under any topographic and climatic conditions.

Diagram of the Increase of the Maximum Capacity of Hydroelectric Power Stations (a) and the Unit Capacity of Hydraulic Turbogenerator Units (b)



The generation of electric power at hydroelectric power stations not only makes it possible to save a large amount of fuel resources, but is also distinguished by the lowest production cost. The average production cost of 1 kilowatt-hour generated at hydroelectric power stations in 1975 was 0.163 kopeck, which is nearly 5 times less than the production cost of electric power at thermal electric power stations. The number of hours of utilization of the installed capacity of GES's in 1976 was 3,631 hours.

The data on the increase of the installed capacity and the generation of electric power at USSR hydroelectric power stations are cited in Table 13.

Table 13

(1) Год	(2) Мощность ГЭС		Производство электроэнергии (5)	
	(3) млн. кВт	(4) % мощности всех электростанций	(6) млрд. кВт·ч	(7) % всего производства в стране
1913	0,015	1,4	0,034	1,7
1921	0,018	1,5	0,01	1,9
1930	0,13	4,5	0,55	6,6
1940	1,6	14,5	5,1	10,6
1945	1,3	11,3	4,8	11,2
1950	3,2	16,4	12,7	13,9
1955	6,0	16,1	23,2	19,6
1960	14,8	22,2	50,9	17,4
1965	22,2	19,3	81,4	16,1
1970	31,4	18,9	124,4	16,8
1975	40,5	18,6	126,0	12,1
1977 (план) (8)	45,0	19,1	153,0	13,2

Key:

1. Year
2. Capacity of GES's
3. Millions of kWt
4. Percent of capacity of all electric power stations
5. Generation of electric power
6. Billions of kWt-hr
7. Percent of all generation in the country
8. Plan

Electric Power Networks

The Soviet Union has considerable achievements in the development of electric power networks.

The first 110-kV high tension line in our country was the 120-km Kashira-Moscow line, which was built in 1922. In 1932 the 154-km Dneproges-Donbass line was put into operation and in the same year the construction of the first 220-kV Svirskaya GES-Leningrad line measuring 240 km in length was completed.

In 1956 the first multiple-wire 220-kV Southern Urals-Chelyabinsk line measuring 220 km in length was built. In the same year the 400-kV Volzhskaya GES imeni V. I. Lenin-Moscow electric power transmission line

measuring 790 km in length was put into operation and in 1958 the Volzhskaya GES imeni V. I. Lenin-Sverdlovsk line measuring 1,050 km was put into operation. Both of these lines were subsequently converted to a tension of 500 kV, and in 1959 the first 500-kV Volzhskaya GES imeni XXII s"yezda KPSS-Moscow overhead line measuring 1,004 km in length was put into operation.

In 1956-1960 the first 330-kV lines were built in a number of power systems. In subsequent years the rate of construction of regional and intersystem electric power transmission lines, especially with a tension of 220-500 kV, increased considerably and even outstripped the growth rate of the installed capacity of electric power stations. This was caused by the building of a large number of major thermal electric, hydroelectric and nuclear electric power stations, the formation of united power systems and the overall development of intrasystem and intersystem electric connections.

During the same period intersystem electric power transmission lines of a higher tension--800 kV direct current and 750 kV alternating current--were built, scientific research and planning work were carried out on the creation of electric power transmission lines of even higher tensions.

In 1967 the pilot industrial 750-kV alternating current Konakovskaya GRES-Belyy Rast electric power transmission line mearuing 90 km in length was put into operation, while in 1975 the construction of the 750-kV Donbass-Western Ukraine latitudinal main line was completed. In the same year the 750-kV Leningradskaya AES-Konakovskaya GRES electric power transmission line measuring 525 km in length was also put into operation.

The data of Table 14 characterize the dynamics of the development of electric power transmission lines with a tension of 35 kV and more during 1961-1975 and during the Tenth Five-Year Plan.

Table 14

(1) Напряжение, кВ	(2) Протяженность линий, тыс. км				
	1960 г.	1965 г.	1970 г.	1975 г.	1980 г. (план) (3)
1150	—	—	—	—	0,3
750—800	—	0,5	0,6	2,2	3,0
500	4,4	8,2	12,6	18,9	28,0
400	—	0,1	0,5	0,5	0,5
330	1,1	7,3	14,2	19,5	26,0
220	15,6	35,2	50,3	69,5	90,0
154	2,0	5,1	5,8	7,7	8,0
110	64,6	128,1	185,9	244,1	319,0
35	36,7	122,3	175,7	241,6	318,2
(4) Всего	124,4	306,8	445,6	604,8	795,0

Key:

1. Tension, kV
2. Length of lines, thousands of km
3. Plan
4. Total

Rural Networks

The power supply of rural regions from the networks of power systems on an extensive scale was begun in the 1950's and was practically completed during the Ninth Five-Year Plan.

Extensively developed were the rural electric power transmission lines with a tension of 0.4-20 and 35-110 kV, the total length of which by the end of 1975 had reached more than 3.2 million km, of them 260,000 km are lines of 35-110 kV. During the same period a large amount of work was performed on increasing the reliability of rural power networks. In 1971-1975 alone in the rural power networks about 8 million wood poles and attachments, 5 million line insulators were replaced, 200,000 km of aluminum wires were replaced with ferroaluminum wires, 3,000 transformers of size IV and more than 50,000 transformers of 6-10/0.4 kV were equipped with automatic equipment of reconnection and the lead-in of the reserve.

Urban Networks

In 1975 nearly 400 billion kWt-hr of electric power were distributed through urban electric power networks of 6-10 kV, the total length of urban lines of 0.4-20 kV reached 1 million km, of them 280,000 km are lines of 6-20 kV.

Power Systems

The creation of regional power systems and their combination for the entire territory of the country were and remain one of the general directions of the development of Soviet power engineering.

The electric power networks of 95 regional power systems, many of which were created back in the 1920's and each of which ensures the power supply of the consumers, as a rule, of a single oblast (kray), and sometimes of a single union or autonomous republic, at present embrace practically all the inhabited territory of the country. The development of the ties between individual power systems and their combination within zones of the country led to the creation of united power systems (OES's), while the combination of the latter forms the Unified Power System of the country, the USSR YeES.

At present the electric power system of the country consists of 11 zonal OES's--the Center, the Central Volga, the Urals, the Northwest, the South, the Northern Caucasus, Transcaucasia, Northern Kazakhstan, Siberia, Central Asia and the Far East. Together with the formation of the OES's, integrated dispatching administrations--ODU's of the OES--were created for the efficient administration of their operation. The first such ODU was created in 1954 in the OES of the Center.

The construction of major hydroelectric and thermal electric power stations and long-distance electric power transmission lines from these electric power stations to the centers of the load led to the interconnection of the zonal OES's and the formation of the USSR YeES. An important stage of this process of developing Soviet power engineering was the building of the largest hydroelectric power stations on the Volga--the Volzhskaya GES imeni V. I. Lenin, the Volzhskaya GES imeni XXII s"yezda KPSS--and the main electric power transmission lines of 400-500 kV from these GES's to Moscow and the Urals, as well as the 800-kV direct current Volgograd-Donbass line. These electric power transmission lines united the OES of the Central Volga with the OES's of the Center, the Urals and the South and marked the beginning of the formation of the European part of the USSR YeES. Later three more OES's--the Northwest, the Northern Caucasus and Transcaucasia--were connected up with these four OES's, and by the end of the Eighth Five-Year Plan the USSR YeES of the European part of the country had been formed.

The central dispatching administration--the TsDU of the USSR YeES--located in Moscow was created for the efficient administration of the operation of the USSR YeES.

During the Eighth Five-Year Plan the OES's of Northern Kazakhstan, Siberia and Central Asia were created and the formation of the OES of the Far East continued. The United Power System of Siberia became one of the largest in the country, in 1975 its installed capacity reached 27.4 million kWt, while the generation of electric power reached 140 billion kWt-hr. The OES of Central Asia also underwent considerable development.

During the Ninth Five-Year Plan the OES of Northern Kazakhstan was connected with the USSR YeES and the OES of the Far East, the last of the 11 OES's, was formed. By the end of this five-year plan within these 11 OES's there were in operation 85 regional power systems (of the 95) with a total installed capacity of 198 million kWt (90 percent of the installed capacity of all power systems) and an annual generation of electric power of 994 billion kWt-hr (95 percent of the generation by all power systems).

The data on the installed capacity of electric power stations, the amount of the winter maximum load, the annual generation of electric power of the individual united power systems, the USSR YeES and overall for all 11 OES's in 1975 are cited in Table 15.

The installed capacity of the USSR Unified Power System, which now unites about 1,000 electric power stations, in 1977 will reach 166.9 million kWt, while the generation of electric power will reach 883 billion kWt-hr.

The development and constant improvement of the automation of the operations and dispatching administration of the USSR YeES, the OES's and the regional power systems, and the high level of equipment of power systems with means of operation and accident-prevention automation, as well as with means of modern computer technology ensure the reliable and economical operation of the power systems of the USSR.

Table 15

(1) Объединенная энергосистема	(2) Установленная мощность, млн. кВт			(6) Зимний максимум нагрузки, млн. кВт	(7) Годовая выработка энергии, млрд. кВт·ч
	(3) Всего	(4) ТЭС+АЭС	(5) ГЭС		
(8) Центра	29,830	26,141	3,689	29,1	156,1
(9) Средней Волги	12,754	9,094	3,660	10,6	60,8
(10) Урала	25,439	23,684	1,755	21,4	148,8
(11) Северо-Запада	23,009	19,134	3,875	15,8	96,0
(12) Юга	38,445	34,637	3,808	29,9	206,3
(13) Северного Кавказа	8,363	6,660	1,703	6,8	38,9
(14) Закавказья	8,018	5,705	2,313	5,9	35,3
(15) Северного Казахстана	7,240	6,190	1,050	6,0	38,8
(16) Итого по ЕЭС СССР	153,097	131,245	21,852	126,0	781,0
(17) Сибири	27,354	14,430	12,924	21,3	140,1
(18) Средней Азии	11,695	8,376	3,319	7,8	49,6
(19) Дальнего Востока	5,866	5,172	0,694	4,5	23,3
(20) Итого по всем ОЭС	198,012	159,223	38,789	—	994

Key:

1. United power system
2. Installed capacity, millions of kWt
3. Total
4. TES's + AES's
5. GES's
6. Winter maximum load, millions of kWt
7. Annual generation of power, billions of kWt-hr
8. Center
9. Central Volga
10. Urals
11. Northwest
12. South
13. Northern Caucasus
14. Transcaucasia
15. Northern Kazakhstan
16. Total for USSR YeES
17. Siberia
18. Central Asia
19. Far East
20. Total for all OES's

Cooperation With Foreign Countries

The power systems of the Soviet Union operate in parallel with the Mir united power system of the CEMA member countries.

The most important electric power transmission lines connecting the USSR power systems with the Mir OES are the 400-kV Mukachevo-(Shayoseged) (Hungary) line, the 400-kV Mukachevo-Ludus (Romania) line, the 400-kV Moldavskaya GRES-Dobrudzha (Bulgaria) line, the 220-kV Ross'-Belostok (Poland) line, the 220-kV Dobrotvorskaya GRES-Zamoste (Poland) line and others; the 750-kV Vinnitsa-Albertirsa (Hungary) electric power transmission line is being built.

The development of the ties between the power systems of the USSR and the CEMA member countries ensured the expansion of the traffic of electric power between them and the more efficient use of power resources and increased the stability and reliability of the operation of the power

systems. In 1975 the delivery of electric power of USSR power systems to CEMA member countries reached about 10 billion kWt-hr.

In 1976 the 220-kV Gusinoozerskaya GRES-Naushki electric power transmission line connected the power system of Buryatia with the power system of Mongolia.

USSR power systems also have ties with the power system of Finland through the 110-kV Lenenergo-Imatra hydroelectric power station line and with the power system of Norway through the 110-kV Borisoglebskaya GES-Northern Norway line.

The Soviet Union is cooperating extensively with foreign countries in the designing and construction of power projects, above all with the CEMA member countries. In 1971-1975 alone the Soviet Union delivered to foreign countries power equipment for electric power stations with a total capacity of 18 million kWt, of them 10 million kWt to CEMA member countries, while in all 220 power projects with a total capacity of 46 million kWt have been built and are under construction with USSR technical assistance in more than 30 countries of the world.

With USSR technical assistance there have been built in the socialist countries the thermal electric power stations of Varna, Russe, Devnya, Maritsa-Vostok and Bobov Dol in Bulgaria, (Dunamenti) and (Dendesh) in Hungary, (Tirbakh) and Boxberg in the GDR, (Turuv) and Kozenice in Poland and (Borzeshti), (Mintiya) and Galati in Romania, the TETs of Darhan and TETs-3 (Ulan Bator) in Mongolia, (Mariel) and (Rente) in Cuba, the TETs's in North Korea, the TETs of (Uong Bi) in Vietnam and others, a number of hydroelectric power stations, the largest of which is the GES of the Portile de Fier on the Danube, the Nord nuclear electric power station in the GDR, the Kozloduy nuclear electric power station in Bulgaria and others, a large number of electric power stations of different types are in the process of construction.

The Soviet Union is giving much assistance to developing countries in the construction of power projects. With USSR technical assistance hydroelectric power stations have been built or are being built in Egypt (Aswan), Syria (Tabka), Afganistan (Naglu), India, Morocco, Brazil, Somali and others; thermal electric power stations--in India, Morocco, Iraq, Algeria and others.

The Soviet Union is delivering various power equipment: hydraulic turbines, turbogenerators, transformers, to Canada, Brazil, Norway, the United States and Finland; nuclear reactors and other equipment for the Lovis nuclear electric power station in Finland and others.

These forms of participation of the Soviet Union in the international division of labor are clear confirmation of the technical progress achieved by our country in the area of electric power engineering, power machine building and the electrical equipment industry.

The successes in the development of electric power engineering, which have been achieved during the 60 years of Soviet power, were first of all the result of the heroic labor of power workers-operators, construction workers, designers and scientists, the workers of power machine building and the electric equipment industry, who under the leadership of the Communist Party expanded the campaign for the implementation of Lenin's plan on the electrification of the country.

Stressing the greatness of the labor accomplishments of the Soviet people, CC CPSU General Secretary L. I. Brezhnev said at the 25th CPSU Congress: "...they, precisely they, in fulfilling the plans of the party, are raising the Soviet Union to newer and newer heights of progress. And, in calling our times the time of great accomplishments, we give their due to those who made it such--we give their due to the people of labor."

The army of Soviet power workers, which is carrying out the struggle in the first line of the building of communism, is growing annually.

Even more power workers are working in all sectors of the national economy of the country.

In 1971-1975 more than 74,000 young specialists, who had completed higher educational institutions and tekhnikums, were sent to enterprises and construction projects of the USSR Ministry of Power and Electrification. Annually 10,000-12,000 power workers, who combine practical work with studies, complete VUZ'z and tekhnikums. A large number of them study at an institute for increasing skills and its branches and at academic combines. In 1971-1975 alone academic combines trained about 650,000 new workers.

In electric power engineering advanced labor methods are being extensively introduced, mass socialist competition is being held for the early fulfillment of production assignments and for the achievement of technical progress. At the head of this mass movement are production innovators, the competition leaders and our youth. The Leninist Komsomol, as far back as 1930, the year of the 10th anniversary of the plan of GOELRO, having assumed patronage over electrification, during the years of recent five-year plans declared the major power construction projects as All-Union Shock-Work Komsomol Construction Projects. Tens of thousands of Komsomol envoys are doing shock work at these construction projects.

The collectives of power workers annually assume socialist obligations on the early fulfillment of production assignments, the above-plan savings of fuel, the increase of labor productivity and the putting of new power capacities into operation.

The Communist Party of the Soviet Union and the Soviet Government have always highly rated the heroic labor of Soviet power workers. During the Ninth Five-Year Plan alone the CC CPSU, the USSR Council of Ministers and

Comrade L. I. Brezhnev personally saluted 18 power enterprises and organizations. Tens of electric power stations, construction trusts, planning institutes and other enterprises of power engineering were awarded orders of the Soviet Union for high work indicators.

The lofty title of Hero of Socialist Labor was awarded to many power workers. Tens of thousands of the best power workers were awarded orders and medals of the Soviet Union.

Soviet power engineering has traveled a long 60-year path, great are its achievements on this path, which is lit up by Lenin's general formula "Communism is Soviet power plus electrification of the entire country."

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PETROLEUM FACILITIES PORT AT CHELEKEN

Moscow EKONOMICHESKAYA GAZETA in Russian No 48, Nov 77 page 14

[Article by P. Antonov: "Port at Cheleken"]

[Text] There are different types of ports on the Caspian: general cargo and passenger, fishing and oil tanker, and harbors of other designation. But oilfield port is a totally new concept in marine construction engineering. The port on the Cheleken Peninsula is just such a facility.

On the this peninsula Kaspmorneft' is putting into production oilfields located beneath the sea bed.

There are several base facilities concentrated in the port -- offshore drilling, drilling equipment maintenance and repair, assembly, pipe, offshore oilfield operation and maintenance, ship, fleet supply, bunkering, and fleet maintenance, which are usually sited separately.

There are many base facilities, and each has its own function, but all together they constitute a single mighty complex. The port designers, headed by project chief engineer Mikhail Petrovich Yepifanov, gathered together into a "fist" functionally different petroleum industry enterprises.

Today one can see from several miles offshore the steel-frame "legs" of two gantry cranes. Entering from the sea into the harbor, guarded by a curving breakwater, one marvels at these cranes, which appear to be walking on water. Under them is the sea, not the stone or concrete of a dock. A dual-strip pier, which doubles as a crane track, is also one of the sights of interest in the port of Cheleken. Only a pier of this design provides maximum convenient loading of the shore-assembled foundation units for offshore drilling rigs. A pontoon or floating crane stands between the pier strips, and the gantry cranes almost playfully place a 200-meter long cargo on the deck of the receiving vessel. A signal from the tug, and they head out to sea, to put in place the base of a new drilling platform.

This port contains many innovations resulting from the initiative of the port construction engineers, saving the country hundreds of thousands and even millions of rubles. Take, for example, the breakwater which separates the outer from the inner roadstead. It was to be constructed of rock fill.

We should note that a cubic meter of rock hauled from Krasnovodsk costs 30 rubles.

Initially that is how they proceeded: the part of the breakwater along the shore is entirely of rock fill. Subsequently, however, it was acknowledged to be much better to make hollow reinforced concrete structures, tow them out to sea, fill them with sand and sink them. This clever solution resulted in total savings of 2.2 million rubles.

Can port construction activities on an open roadstead be conducted in storm and gale? According to all the rules they cannot. But the people of Cheleken proved that it can, and here is how. They had at their disposal the long-since retired tanker "Kiliya." They scuttled it a short distance from the work site. The tanker's hull breaks the heavy seas. As a result construction on port facilities is not interrupted even during fierce winter storms.

Even greater savings -- 1.7 million rubles -- were achieved due to a radical change in the supply hauling arrangement.

Of course these new innovations involved the direct participation of the chief of the floating construction detachment, Honored Efficiency Innovator of the Turkmen SSR Boris Grigor'yevich Shevchuk, an expert in marine construction engineering and a thrifty manager, spending the state's money wisely at every turn. Here is an example: this is the only construction organization on the entire Caspian coast to have set up truck scales. Regardless of what kind of load a truck is carrying, it is sent to the scales. This has put an end to overstating loads; extremely careful records are taken.

The oilmen of Cheleken are building at sea a town on pilings reminiscent of the famous Neftyanyye Kamni. Construction has not yet been completed, but even in its present state the oilfield port is a reliable bridgehead for comprehensive exploitation of Caspian offshore oilfields.

3024
CSO: 1822

BRIEF REPORTS FROM PETROLEUM REGIONS: TYUMEN', TATAR ASSR, KOMI ASSR

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 30 Nov 77 p 1

[Article; individual authors indicated in text: "Mineral Resources Are Conquered by the Skilled"]

[Text] The enterprises of the Ministry of the Petroleum Industry provided the nation's economy with more than 1 million above-target tons of crude oil and gas condensate. Consolidating the successes achieved in the course of socialist competition in honor of the 60th anniversary of the Great October Socialist Revolution, leading teams of oil producers are mobilizing new oilfield reserves.

The oilmen of Western Siberia are presenting a fine example. Working under exceptionally difficult climatic conditions, among swamps and taiga, they are overfulfilling their targets month after month.

The experienced work forces of the Tatneft', Bashneft' and Kuybyshevneft' associations are doing a fine job, further developing fields the natural reserves of which have declined. In this situation it is necessary to wage a persistent struggle literally for each and every additional ton of crude.

The oilmen's success depends in large measure on the performance of the drillers, who are creating new productive capacity for the petroleum industry. Since the beginning of the year drillers have turned over to production crews more than 4,000 wells -- 350 more than specified by the plan. A definite factor has been the large scale of competition among crews of adjacent areas of specialization, begun at the initiative of Tatar foreman D. Nurutdinov.

The achievements of the workers in this branch, however, could have been much greater if it were not for the performance lag on the part of a number of enterprises. The Permneft', Turkmenneft', Kaspmorneft', and Mangyshlakneft' associations are failing to meet their targets. Altogether they lagged behind target by 4,760,000 tons of liquid fuel. Including above-target production by leading work forces, this amount of oil would have been sufficient to triple-overfulfill adopted pledges and to double-overfulfill the specified additional target!

The directors of lagging enterprises emphasize objective factors: exhaustion of natural resources, and worsening of oilfield geologic conditions. In many cases difficulties of this kind indeed occur. As a rule, however, they are not the reason for failure to meet planned targets; the reasons are errors and miscalculations in daily work.

Take, for example, the fairly large Permneft' Association, where this year there was a sharp decrease in well productivity. The reason for this is a departure from optimal oilfield production conditions. This resulted in failure to meet the production target by more than 1.5 million tons.

One cannot help but be alarmed by the fact that in November the rate of crude oil production dropped off somewhat below the targeted figures. Oilmen completed the first 20 days of the month with a "minus" of 266,000 tons.

The petroleum industry has the capability of more fully satisfying the growing requirements of the nation's economy in fuel and valuable chemical raw materials.

Today our own correspondents tell our readers what reserve potential is being mobilized by competition leaders under the slogan "A Shock-Work Finish to the Jubilee Year!"

Tyumen': A Count in the Millions -- V. Noskov

This country's main oil and gas production base is developing at a rapid pace. Having completed ahead of schedule pledges in honor of the 60th anniversary of the Great October Revolution, the Glavtyumenneftegas work force resolved to boost the above-target score to 5 million tons of "black gold." They are close to the goal: already more than 4.3 million tons of above-target crude has been extracted from the Siberian fields. At the finish of the jubilee year the Tyumen' oilfield workers have reached a record daily crude oil production level: 600,000 tons.

"Many of our work forces are skillfully finding 'keys' to the underground treasure troves," stated F. Arzhanov, chief of Glavtyumenneftegaz. "The complete-unit method of oilfield construction is being employed on a large scale, high-output electric centrifugal pumps are being adopted for extracting crude at a faster rate, and there is occurring intensive water injection into producing levels to maintain formation pressure. All this is helping accomplish the tasks assigned to the oilmen of Western Siberia by the 25th CPSU Congress."

The drillers are doing a good job this year. More than 40 brigades have already completed the targets for the first two years of the five-year plan. They include the work forces under the direction of G. Levin, V. Gromov, V. Shchava, B. Volkov, and B. Davydov. Each of these brigades drilled more than 60,000 meters this year. The drilling crews are also running ahead of the schedule for completing drilling and turning over wells to the production crews.

Approximately 400 wells have been converted over to mechanized production. Alongside the adoption of new crude oil initial processing techniques in the oilfields, segregated oil production is employed. This technique is essentially as follows: only water-containing crude is collected in the tanks, while water-free crude is pumped directly from the oilfield to the refinery. This makes it possible to utilize available equipment and facilities more efficiently.

The famed Samotlor, development of which is being conducted by the work forces of the Nizhnevartovskneft' and Belozerneft' administrations, continues to show the greatest production growth. The Pokachevskoye field went into production a few days ago -- the fourth since the beginning of the year. New facilities to maintain formation pressure have gone into operation in the Fedorovskoye field.

Organization of the labor of the conquerors of the mineral resources of Siberia is also improving. Recently the method of the brigade contract for oil well construction began to be employed in this area. Initial results are promising: there is occurring less idle time for derrick installation crews, drillers, geophysicists, and construction crews, and wells are being put into production faster.

The labor force, numbering many thousands of workers, is persistently mobilizing new reserve capability in order to build a firm foundation for shock work in the third year of the five-year plan.

Tatar ASSR: Formations Are Yielding More -- Yu. Kosov

On the eve of the opening of the Special Seventh Session of the USSR Supreme Soviet, the work force of the Order of Lenin Tatneft' Association reported completion of socialist pledges in honor of the 60th anniversary of the Great October Revolution. Not much time has passed since this country celebrated the glorious jubilee, but the oilmen of the Tatar ASSR, who took up competition under the slogan "A Shock-Work Finish to the Jubilee Year!", have achieved a new performance level. They have completed the year's pledges ahead of schedule. The country has received above-target more than 250,000 tons of valuable raw materials.

But even this figure is past history. Right now the campaign is focusing on increasing the above-target total.

Tatar oil is not easily extracted today. The republic's principal fields have entered a late stage of production. Under these conditions much persistence and diligence are required in order to prevent a sharp decline in the level of production.

A large complex of measures is being carried out in the oilfields of the Tatar ASSR to achieve intensification of production and to increase yield. Oilmen are extensively employing point water injection. Heat treatment of well bottoms has made it possible to boost well productivity. Approximately 200 previously inactive wells have gone into production since the beginning of the year.

Working by drilling crews on a continuous cycle has promoted accelerated well drilling and production startup. A total of 93 above-target completions have been recorded, while the average time to put in a well has decreased by 10 and a half days.

In the socialist competition lead at year's end are the work forces of the Suleyevneft', Yelkhovneft', Aznakayevskneft' and Aktyubaneft' oil and gas production administrations. More than 50 brigades have already completed the targets of the first two years of the five-year plan.

Komi ASSR: Oil at the Arctic Circle -- V. Krukovskiy

The Komi ASSR -- one of the country's oldest oil producing areas -- is today experiencing a second youth. Oilmen are successfully tapping new oilfields at the Arctic Circle.

During the days of preparation to celebrate the October jubilee, drilling crews were engaged in competition to drill deep wells ahead of schedule. The competition was headed by young foreman S. Melekhin. Soon he was challenged by his former crew member and pupil N. Dobryakov. They were given worthy competition by drilling brigade chiefs V. Sbrodov, N. Bormatov, Ye. Pugachev, and L. Sharifullin. Approximately 80 wells have been drilled since the beginning of the year, including 10 above-target wells.

But drilling down to oil is only half the job. It is also necessary to utilize the new wells in an intelligent manner. Here the decisive word was stated by the operators of the Usinskaya and Vozeyskaya engineering and technological services.

Here is the result: recently the association produced its 400,000th ton of above-target crude. An additional 30,000 tons of above-target fuel will be produced by year's end.

These days the Komineft' Association is making preparations to reach a notable figure: for the first time annual oil production in the European North will exceed 10 million tons. Persistent competition is in progress for the right to "round off" this figure.

Among the leaders are teams working in the republic's old fields. This year the oilmen of Nizhniy Odes, Voy-Vozh and Yarega not only succeeded in preventing a reduction in the rate of production but also, utilizing the newest methods of intensification of boosting flow, produced tens of thousands of tons of above-target fuel.

"Our oil production will increase sharply in the subsequent years of the five-year plan," stated A. S. Gumenyuk, general director of the Komineft' Association. "In order to meet the targets of the immediate future, we must practically double drilling, delivery of supplies, and road construction."

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PETROLEUM GEOLOGY TRACED OVER SIX SOVIET DECADES

Moscow NEFTEGAZOVAYA GEOLOGIYA I GEOFIZIKA in Russian No 10, Oct 77 pp 3-7

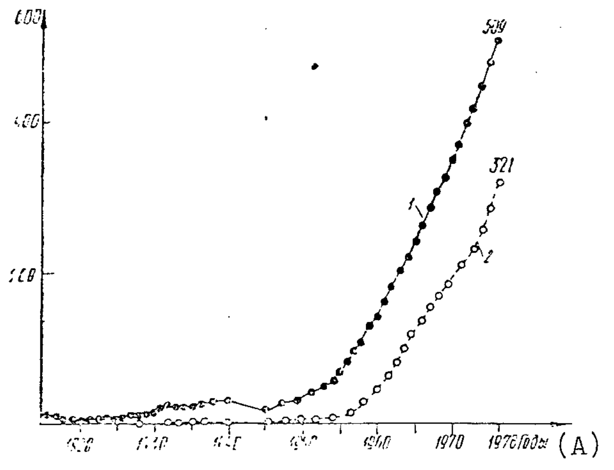
[Article by E. M. Khalimov and N. A. Krylov, USSR Ministry of the Petroleum Industry and Institute of Geology and Development of Mineral Fuels; "Petroleum Geology on the 60th Anniversary of the Great October Socialist Revolution"]

[Text] The 60-year-long history of our socialist country is a period of intensive growth of the oil and gas industry. Oil recovery grew ten times over the 60 years of Soviet power. The gas industry reached a high level of growth (see Figure) as well in this period.

Discovery of new fields was the foundation for the growth of oil and gas recovery in our country. In the years of Soviet power, not only was a strong raw-material base established, underwriting the successful growth of the oil and gas industry, but the geography of oil and gas recovery changed radically. From the early thirties, after the civil war and the reconstruction of the oil industry in the old regions of Azerbaydzhan, Northern Caucasus, Central Asia and Western Kazakhstan, exploratory-prospecting strides moved on in a broad front in many parts of the country. Soviet petroleum geologists won their first outstanding success in the discovery and mastery of the Volga-Urals oil and gas province. In 1929 the subsalt deposits near Chusovskiye gorodkiye were found to contain oil. High-yield gusher inflows were tapped in 1932 in similar geological conditions near Ishimbay. By 1941 14 fields with beds in Carboniferous and Permian deposits were discovered in the province. In the Great Patriotic War the number of fields discovered went up 2.5 times. Finding the high-yield oil deposits in the terrigenic strata of the Devonian in the Tuymazinskoye oil field in 1944 was a striking accomplishment.

Mastery of the Devonian deposits made possible a significant increase in oil recovery in the Ural-Volga area. The most impressive achievement was the discovery, prospecting and initial exploitation of the Romashkinskoye field in the Tatar ASSR.

The past decade saw special attention centering on exploring for oil in the Carboniferous deposits of the Kamsko-Kinel'skaya system of troughs transecting the Volga-Ural province. This avenue of operations now figures prominently in the increment in commercial oil reserves in the province.



Dynamics of oil and gas recovery

1. oil, millions of tons (including gas condensate)
2. gas, billions of m^3 (including gas condensate)

KEY:

A. years

Oil reserves prospected in Paleozoic deposits of the Ural-Volga area laid the foundation for the swift rise of the country's oil recovery industry and ensured for the five postwar five-year plans most of the gains in oil recovery. This province even today stands out for its high recovery level.

In the postwar period discovery of oil-gas provinces in the juvenile platforms --cis-Caucasian, Turanskaya and Zapadno-Sibirskaya--was the most salient success in exploratory-prospecting efforts; in these areas most reserves are associated with the Jurassic and Cretaceous deposits. The first commercial inflows of oil and gas from the Mesozoic strata were obtained nearly at the same time from three platforms: in 1952 the Promyslovskoye gas field, small in reserves, was found in the northeast of the cis-Caucasus area and in 1953 the Ozeksuatskoye oil field was discovered, the Setalantepinskoye gas field in Central Asia and the Berezovskoye gas field in Western Siberia. Earlier still (in 1946), gas finds were made in the Paleogenic in the Stavropol'skiy anticline in the cis-Caucasus.

Discovery of the Western Siberian province bears the greatest significance in the present-day stage of the growth of the oil and gas industry. On the heels of the finding of the Berezovskoye gas-bearing (1953) and Shaimskoye oil-bearing regions in the cis-Ural part of the province, oil-bearing regions were discovered in the Central cis-Ob' region (1961) and gas-bearing regions

in the North. Among the deposits are found the Samotlorskoye oil and Urengoyskoye, Medvezh'ye and Zapolyarnoye gas fields. These finds turned Western Siberia into a vital province for the preparation of oil and gas reserves in commercial categories in recent years. This province's role will be sizable in the plan targets for increment in oil reserves for the current five-year plan.

Discoveries of oil fields in Western Siberia were responsible for high rates of oil recovery in the country.

The increment in gas reserves in Western Siberia was also significant as early as the Seventh Five-Year Plan; in the Eighth and Ninth five-year plans it grew further.

New discoveries during the past 20 years were made also in other parts of the platform. Vital importance lies in the discovery and prospecting of the Gazlinskoye gas, Uzen'skoye oil, Shatlykskoye gas and several other fields containing deposits in the Jurassic, Lower Cretaceous and Senomanian in the Turanskaya platform.

Successes of petroleum geologists in the recent period include the exploitation of the Dnepr-Pripyatskaya oil-gas province, discovery of oil and gas finds in the Timano-Pechorskaya province (in the Komi ASSR and Arkhangel'skaya Oblast), in the Baltic orogenic syneclise in the Lithuanian SSR and Kaliningradskaya Oblast and establishing the oil-gas status of the subsalt Paleozoic in the cis-Caspian province (Western Kazakhstan and Astrakhanskaya and Saratovskaya oblasts). These discoveries are related to the ancient Eastern European platform, predominantly including Paleozoic age horizons--from the Cambrian to the Permian.

Searching and mastering oil and gas fields in the Eastern Siberian ancient platform is vital to the long-term growth of our country's economy. Here the first oil inflow came from Cambrian deposits at the Tolbe River as early as the thirties. Three oil-gas provinces were evidenced here by the discovery of the commercial gas status of Mesozoic deposits in the Yakutsk ASSR (1955) and in Krasnoyarskiy Kray (1966) and the commercial oil status of the upper part of the Upper Precambrian in Irkutskaya Oblast (1962). The earliest possible of these finds and the exploration for new oil-gas territories in Eastern Siberia is a national-economic undertaking of prime importance.

Under Soviet power the Yuzhno-Tadzhikskaya, Sakhalinskaya and Chukotskaya oil-gas regions were discovered, along with a number of oil fields in Georgia, new deposits in Western Turkmenia, Fergana, and in the Grozny and Krasnodar oil-bearing regions.

In the postwar years oil fields were discovered in the Caspian Sea--Gyurgyany (1947), Neftyanyye Kamni (1949) and numerous others.

Two stages--prewar and postwar--can be distinguished in the history of the growth of the oil and gas industry in the six-decades' period; these stages

differ by levels and pace of gains in oil and gas recovery and by the end results of searching and prospecting for oil and gas. Oil recovery in 1940 rose eight times over the 1920 level; and 1976 oil recovery was ten times the 1945 output. The difference between these stages stands out distinctly also when we compare the pace of discoveries of new oil-gas fields. Upwards of 80 percent of the fields known in our country as of early 1977 was found in the postwar period. And the maximum number of discoveries happened during the three last five-year plan periods. The postwar period was noteworthy for large volumes of geological exploratory efforts and prospecting drilling, the broad sweep of promising territories and the discovery of new fields, oil and gas-bearing regions, areas and provinces.

The effectiveness of exploratory and prospecting work to find oil and gas in our country overall is improving, even though some places it is not good enough.

This effectiveness depends heavily on the high level of Soviet oil and gas geological science.

Soviet oil and gas geological science, pioneered by I. M. Gubkin, D. V. Golubyatnikov, G. P. Mikhaylovskiy, K. P. Kalitskiy and other eminent scientists, passed through a long path of searching and discovering. Basic to its development is the postrevolutionary period. Over the 60 years of Soviet power major successes were reached in all areas of research: in the theory of the origin and conditions of formation of oil and gas deposits; study of the correlations of the location of deposits and zones of oil and gas accumulation; qualitative and quantitative prediction of the oil and gas content in territories with the aim of a scientific substantiation of promising directions and specific objects for oil and gas searching, as well as in the field of improvements in the methods of prospecting and the methods and procedures of exploiting oil and gas fields. An outstanding contribution to the development of petroleum geological science was made under Soviet power by M. V. Abramovich, A. A. Bakirov, I. O. Brod, M. I. Varentsov, M. A. Kapilyushnikov, N. A. Kudryavtsev, S. I. Mironov, M. F. Mirchink, V. P. Savchenko, V. A. Sokolov, S. F. Fedorov, A. V. Ul'yanov and many other scientists.

New accomplishments were recorded in the postwar years, particularly in recent decades, in petroleum geology. For example, joint study of isotopic composition of hydrocarbons, sulfur and hydrogen helped outline new avenues in the diagnostics of oil-gas-conductive formations. Investigation of the chemical composition and structure of hydrocarbons in petroleum--at the molecular level--furnished new arguments favoring the organic origin of petroleum and helped frame their genetic classification.

Directions and degree of transformation of organic matter in diagenesis and in early stages of catagenesis were ascertained. An intimate relationship was uncovered between petroleum formation and certain thermobaric conditions of the earth's interior; characteristics of the principal phase of petroleum formation were formulated.

Transport of heavy hydrocarbons by compressed gases was shown experimentally possible. Geochemical, hydrodynamic and geological criteria for determining pathways and mechanisms for the migration of hydrocarbons were worked out.

Integrated studies of the location of oil and gas segregations were conducted; they revealed spatial interrelationships of the zones of petroleum formation and petroleum segregations in a number of oil and gas-bearing provinces. A correlation was established between the oil and gas status of positive structures with adjoining depressions. The distribution of oil reserves by zones of catagenesis was brought to light.

Fundamental criteria for prognosis of the quality of reservoirs and cap rocks in different geological conditions [were developed].

Direct geochemical indicators of oil and gas status were established: content of benzene, toluene and phenols in formation water and the composition and vapor pressure of water-soluble gases.

Methods of quantitatively estimating the prospects of oil and gas status were developed, grounded on geological analogies. Genetic methods of quantitative prognosis of oil and gas status are being formulated. All of the USSR was given a differentiated prognostic estimate; it is regularly (every five years) revised in light of new geological-geophysical data. Successfully under development are the scientific essentials for long-term planning of geological prospecting for oil and gas.

Petroleum geological science is exerting a swelling influence on the practice of exploratory and prospecting work. Geologists and geophysicists of scientific research institutes of the Minnefteprom [USSR Ministry of the Petroleum Industry], Mingazprom [USSR Ministry of the Gas Industry] and the Mingeol [USSR Ministry of Geology] are directly participating in ongoing and long-term planning of exploration and prospecting of oil and gas deposits.

The present stage of buildup in searching for oil and gas in our country is characterized by growing complexity of geological field conditions, stemming from the faster entry into new and poorly-studied regions, from the transition to prospecting for more complexly disposed deep-lying beds and from searching for nonstructural-type deposits. In these conditions requirements intensify even further for the need of more improvement in petroleum geological science.

Figuring prominently is oil and gas field geology in solving the problem of the optimal exploitation of oil and gas deposits, achievements of full exploitation of oil and gas reserves and the economical utilization of mineral wealth. In bearing down on the significance of geological investigations as deposits are worked, as long ago as 1918--the first year following the nationalization of the oil industry, I. M. Gubkin in the article, "Role of the Geologist in the Oil Industry," emphasized that the geologist must be the leader in exploiting oil deposits if this exploitation is to proceed correctly and

systematically and end up with the maximum in practical results. In narrowing the meaning of the geologist participating in exploitation, the eminent petroleum scientist, founder of oil and gas field geology in our country, wrote that the supervision of the working of a field can be fruitful only assuming an inflexible condition--a knowledge of the geology of the field in all its details.

I. M. Gubkin maintained that the geologist must be assigned to the field for many years, as long as its exploitation goes on, for the full possibility of studying the field in all its details and supplying not an imaginary, but a true idea of its structure and the conditions of oil bedding. The Soviet state, party and government, in solving problems of the accelerated growth of the national economy, always gave first-priority significance to the full, but economical use of mineral resources. So at all stages of progress in the Soviet oil industry, the geologist's role was pace-setting not only in searching for and prospecting deposits of hydrocarbons, but also in exploiting them.

Up-to-date methods of working oil fields are rooted in achievements in hydrodynamics, physical chemistry, oil and gas field geology and economics.

Further advances in the theory and practice of petroleum activities presuppose careful and balanced study of the exploited site in a producing stratum, the hydrocarbons and formation water, their interaction with the stressing agent and their behavior during exploitation. So employing geological field methods of investigating oil and gas deposits and fields in the past several years has expanded significantly. Petroleum geologists are now confronting more complex concerns; their correct resolution is highly pivotal in the choice of the optimal system of exploitation and establishing the well operating regime. Requirements have stiffened appreciably as to the scientific justification of plans for exploitation and measures for improvement in recovery processes and the fuller tapping of oil and gas reserves. Even so, the geologist's "arsenal" has grown larger. Today he has modern equipment and the latest in methods of investigation.

Traditional methods of geological field analysis became more perfected and enriched with new procedures and approaches; the scope of problems handled by the methods of oil field geology has broadened. New and more stringent requirements are being advanced as to the processing of geologic information; it is becoming a necessity to acquire more reliable information on the lithologic characteristics of rock, their macro- and microstructure with the aim of weighing the possibility of applying physical chemical methods of acting on the stratum and regulating the exploitation process.

Completeness in studying the geologic structure of a deposit as before determines how successfully the problem of increasing the oil flow will be solved. The significance of oil and gas field geology, armed with the achievements of allied fields of science, has grown even more. The system of exploitation buttressed on the concept of geologic structure based on data from drilling the first wells has gone unchanged for several decades. At present,

continuous geological field study is going on, accompanied by the full process of exploitation from the first day to the last. Data from this analysis represent the foundation of the process of competent and economically justified exploitation of a field. The initial system of exploitation is continually being perfected.

A certain trend can be seen: the more oil is brought out of a deposit, the greater effort must be expended in bringing out the residual oil. So the role of geological research is mounting, determining the optimal conditions of exploitation and increasing the completeness of oil tapped from strata at the final stage.

Since growth rates in the proven oil and gas reserves in the world lag behind the rates of mounting demand for oil and gas, the problem of increasing the oil returns takes on growing significance and becomes increasingly acute. The significance and role of oil and gas field geology in solving the oil returns problem are thus increasing. To satisfy the new requirements, traditional geologic methods must be improved and must be enriched with advances in other fields of science.

The need for continual improvement in methods of geologic study is dictated not only by growing complexity in the tasks, but also by an increase in the number of fields discovered and by the expansion in the range of their natural features. Field investigations conducted early in the fifties with high-precision deep-well instruments at the Tuymazinskoye field revealed that the strata are inhomogeneous by layer and the displacement of oil by pumped water occurs nonuniformly in the stratum. Also inhomogeneous are the laminated strata of the Romashkinskoye field. Even more complex is the structure of strata at the Uzen'skoye field. Significant difficulty in exploitation comes from the paraffinic, high-tar petroleum that is unique in properties. Working of the fields in Western Siberia will be accompanied by a number of serious difficulties associated with the displacement of oil by water from inhomogeneous and laminated strata formed by polymictic rock.

Optimization of the exploitation of inhomogeneous strata aimed at maximum oil recovery rates, increase in the oil returns of strata and reduction in the volume of incidentally recovered water, with moderate capital and operating costs, is tied in with the further improvement of the systems used, with the use of new exploitation methods and also methods of monitoring and regulating. Broad prospects open up with the development of physical chemical methods aimed at improving the waterflooding process. The effectiveness of using new methods depends substantially on the geological conditions of the object. Therefore efforts at intensifying exploitation, increasing oil returns and planning new methods must also be based in the full study of the geological features of the field structure.

Facing Soviet geologists and geophysicists are enormous tasks in ensuring the outpacing development of the raw material base and the full and rational use of oil and gas reserves. Their execution will promote the further flowering of the might of our Great Homeland.

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PREREVOLUTIONARY, POSTREVOLUTIONARY OIL INDUSTRY TRACED IN AZERBAYDZHAN

Moscow NEFTEGAZOVAYA GEOLOGIYA I GEOFIZIKA in Russian No 10, Oct 77 pp 7-11

[Article by A. N. Guseynov and B. M. Tsiger, Asneft' Association: Azerbaydzhan: Birthplace of the Oil Industry"]

[Text] The history of Azerbaydzhan's oil industry reaches far back in centuries. Not undeservedly, Azerbaydzhan is called the cradle of the domestic oil industry. Records of ancient historians tell that back in the third and fourth centuries of our era petroleum from Azerbaydzhan was exported to Iran, India, Afghanistan and other lands. It was collected from the surface of the ground and hauled up with leather bags (wineskins) from pits and shallow wells. Khans of Baku farmed out these wells. From an account by mining engineer N. I. Voskoboynikov, in 1825 there were 125 wells operating in the Baku area, yielding 210,845 poods (3.458 tons) of oil a year. From the mid-19th century, upon the invention of the kerosene production technology, vigorous strides in building up the oil yield began, at first at the Apsheronskiy peninsula, and then worldwide. Special wells were drilled to recover oil; oil fields were set up.

The world's first oil well was drilled in 1847 in the Baku area, in the Bibi-Eybatskaya tract; then, in 1869 and 1871, another two wells were drilled in the Balakhany, serving at the beginning for the commercial exploitation of Azerbaydzhan's oil fields.

After the 1872 abolition of the farming-out system, Baku's oil industry began growing rapidly. Big oil recovery companies replaced the small oil entrepreneurs. In 1901 oil recovery in Azerbaydzhan reached a record for those years (some 11.5 million tons), half of the world's oil recovery.

At the same time, foreign oil industrialists stepped up their takeovers of Baku's oil enterprises. In 1880, foreign capital accounted for about 14 percent of all capital investments in the Baku oil industry and in 1912--now more than 40 percent.

Oil industrialists did not bother about the optimal utilization of natural resources and worked hard at acquiring the oil with primitive and unregulated open gusher wells, each day spouting hundreds of thousands of tons of oil.

Much oil went up in smoke. In 1905 alone 1,429 oil derricks burned up. Drilling and recovery techniques were backward. Nearly all work was manual; work was incredibly hard for the laborers; there were no safety units of any kind; merciless exploitation reigned in the fields.

In this period petroleum was brought in only from six tracts of the Apsheronskiy peninsula (Balakhany-Sabunchi-Ramaninskaya, Bibil-Eybatskaya, Surakhanskaya, Binagadinskaya, Artema island and Shubaninskaya) from shallow depths, from the uppermost horizons of the production strata.

Predatory exploitation of the deposits rapidly flooded the rich oil strata. The end of all this was that oil recovery began declining in Baku, after 1901. While in 1901 10.42 million tons was recovered, in 1913 only 7.63 million tons was recorded.

Even more precipitous declines in volumes of oil recovered occurred during World War I (1914-1918). In the years the Musawatists and foreign invaders lorded over Azerbaydzhan, the oil industry found itself in a state of extreme decline. Drilling operations ceased nearly everywhere. The steam power and energy facilities in the fields were wrecked and plundered.

On 28 Apr 20 the heroic Baku proletariat, led by the Communist Party, fraternally backed by the Russian people, overthrew the hated yoke of the Musawat and established Soviet power in Azerbaydzhan.

Two days after Soviet power triumphed in Azerbaydzhan, V. I. Lenin said this, at the All-Russian Congress of Workers in Glass and Porcelain Production: "...it was just yesterday that news came to us from Baku relating that the position of Soviet Russia was showing signs of improving; we know that our industry stands fuelless and now we again are given the news that the Baku proletariat seized power in their own hands.... What this means is that we now have the economic base that can revitalize our industry."[1]

From the very first days of the nationalization of the oil industry, V. I. Lenin was daily engaged with problems of the fastest possible recovery and balanced growth of Azerbaydzhan's oil industry, giving Baku oil workers enormous practical help.

In Oct 22 V. I. Lenin wrote Baku workers:

"Dear comrades! I just finished listening to a brief report by Comrade Serebrovskiy about the status of Azneft' [All-Union Trust of the Azerbaydzhan Petroleum Industry (1934-1935)]. Things are not going well at all.

"In sending you my warm greetings, I ask you to hold out in every possible way for the next several years. Beginnings are especially trying for us. It will be easier later on. We must win out and we will, no matter what.

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[1] V. I. Lenin, "Soch." [Works], Vol 31, 4th ed., p 100.

"Again, I send you best communist greetings.

V. Ul'yanov (Lenin)."[1]

Following V. I. Lenin's direct instructions, trainloads were sent to Baku--equipment, materials, working clothes and foodstuff. By special party decision, S. M. Kirov was dispatched to Baku: he played a large role in the restoration and reconstruction of the petroleum industry.

Responsive to V. I. Lenin's concern, Baku oil workers--led by the Communist Party--fully reconstructed the oil fields at the earliest possible date and were responsible for an upsurge in drilling and for adopting deep-well exploitation instead of the sand pump, subsurface exploitation in place of open gushers.

Guided by S. M. Kirov and the gifted engineer P. N. Pototskiy, in 1923 Herculean labors came to an end in filling in the oil-bearing Bibi-Eybatskaya bay, which Baku workers insisted on renaming Il'yich as a token of the profound love and gratitude they showed to the leader of the revolution.

As early as 1925, the Bukhta Il'yich oil field brought in 10 percent of the total recovery of the Baku area. This was the first offshore field in the Soviet Union; its example demonstrated the high effectiveness of oil drilling in the sea even at that time.

From the first days of the nationalized oil industry, geologists in Azerbaydzhan began profound geologic study and prospecting of oil deposits on the Apsheronskiy peninsula and outside its limit.

As we know, investigations of the pioneering stalwarts in petroleum geology, D. V. Golubyatnikov, I. M. Gubkin, N. I. Usheykin and others, were the first attempts at a systematic study of the oil deposits of Azerbaydzhan, harking back to the early 20th century. However, these studies failed to receive due recognition in the capitalist economic setting of Russia before the Revolution and did not materially influence progress in petroleum engineering.

Only after the Great October Socialist Revolution and the establishing of Soviet power in Azerbaydzhan did geologic science come to occupy a worthy place in petroleum practices.

Broad acceptance was gained for geologic surveying and exploratory prospecting drilling; experimental studies were conducted on the use of geophysical methods--at first gravimetry and magnetometry, then electrical prospecting and seismic prospecting. The volumes of deep prospecting drilling grew year by year.

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[1] V. I. Lenin, "Soch." [Works], Vol 33, 4th ed., p 336.

Success in rotary drilling and the struggle to sink wells faster made it necessary to have more efficient and up-to-date ways of studying well profiles. Electric logging began to appear on the scene for the first time in the Soviet Union in the Baku area in 1929-1930; in a short time, it won wide acceptance and was improved.

Large new fields and deposits of oil were discovered one after the other and the reserves of old fields picked up significantly.

Over the first five-year plan periods, the following well-known Apsheronskiy peninsula fields were discovered: Bukhta Il'yich, Puta, Lokbatan, Kergez-Kyzyltepe, Kala, Karachukhur-Zykh, Mashtagi-Buzovny and others.

North of Apsheronskiy peninsula, in the Kubino-cis-Caspian depression, unusual deposits of Maykop oil were discovered, analogous to the deposits in the Siazanskaya monoclinal. Southward, the first field--the Neftechala--was struck in the cis-Kurinskaya depression.

Even by 1927, the prewar level of oil recovery was reached and the targets of the First Five-Year Plan were reached in 2.5 years. For these successes the Azneft' Association and a large group of Baku oil workers were awarded the Order of Lenin. Oil recovery also developed successfully in the years of the Second and Third Five-Year plan periods.

In 1941, 23.4 million tons of oil was recovered in Azerbaydzhan, 71.4 percent of the country's total. A large part of this amount came from new fields and deposits discovered by Soviet geologists.

From the first days of the Great Patriotic War, the oil industry of Azerbaydzhan became the country's prime base in supplying fuel to the front and the rear. The entire oil industry was rearranged on a military footing. Azerbaydzhan at that time was the main supplier of liquid fuel. It accounted for three-quarters of the countrywide oil recovery and also shipped armament and ammunition to the front.

As this was happening, many drilling offices with their own material and equipment bases, accessories and personnel were relocated in the eastern reaches of the country, where they played a large part in discovering new oil fields of the "Second Baku."

Even by 1944-1945 the first powerful gushers were struck in the Urals, in Tataria, Bashkiria, Kuybyshevskaya Oblast and in Turkmenia, found with the immediate help of Azerbaydzhan oil prospectors.

Right after the victorious ending of the Great Patriotic War, close attention was given to the resumption and further broad development of field, geophysical, exploratory and prospecting drilling in Azerbaydzhan.

In a relatively short time, near the entire oil-promising region of the republic was mapped with instrumental geologic surveying. Azerbaydzhan geophysicists mastered and introduced the latest methods and modifications of units

for geological prospecting. This helped uncover large numbers of new promising structures, where exploratory structural drilling of wells to depths of 1200-1800 m was then carried out.

Logging drilling from longboats and offshore structural drilling from fixed and floating foundations were mastered; this helped in compiling the first geologic map of the entire shelf zone of the Azerbaydzhan part of the Caspian Sea. Exceptional significance lay in the mastery of geophysical prospecting and--primarily--seismic prospecting. In particular, seismic methods completely innocuous for marine fauna have now been mastered and made operational.

Marine seismic prospecting efforts in the postwar period discovered and prepared for deep drilling of tens of previously unknown folds beneath the Caspian seabed.

During the first postwar years the rates of deep prospecting drilling picked up sharply. Also increasing were the mean well depths. Azerbaydzhan drillers --pioneers in extradeep drilling--passed the 5000-meter mark. At the present time some wells on land and off shore are worked from depths of 5500-5800 m.

Prospecting drilling stretches out to all promising regions of Azerbaydzhan, boldly moving into the marine expanses. Besides the deposits of the producing strata, drilling revealed a wide range of other stratigraphy complexes--from the Apsheron-Akchagyl'skiye to the Mesozoic deposits.

What has been done by Azerbaydzhan's oil workers would be impossible apart from a scientifically based approach to organizing prospecting, the latest methods of field and geophysical investigations, concentration of efforts in the most encouraging directions and the concerted energies of geologists, scientists and prospecting drillers.

A number of new multiple-zone oil and gas deposits (Kyurovdag, Mishovdag, Kalmas, Karabagly and Kyursangya) of Middle and Upper Pliocene age were discovered in the cis-Kura depression following lengthy prospecting drilling in complex geologic conditions; these deposits are the base on which a new oil and gas recovery region of the republic was marked out.

On Apsheronskiy peninsula, oil and gas condensate fields and deposits of a new, previously unknown type--Karadag, Zyrya and Gousan--were brought to light in the depression zones of this region by means of advances in extradeep drilling.

The Umbaki and Adzhiveli oil fields were discovered in Gobustan in the early fifties in Miocene-Oligocene age deposits and the Dashgil', Kyanizadag and Duvannyy-susha fields--in the lower horizons of the producing strata.

Continuation of the beds of the Siazanskaya monoclinal was traced in the Siazanskaya monoclinal, in the Amirkhanly and Zagly-Zeyva tracts. Oil presence was established here not only in the Maykop, but also the Chokrakskiye, Paleogenic and Cretaceous deposits.

Small fields and deposits (Mirbashir, Kazanbulag, Naftalan and others) were also found in the Miocene-Oligocene strata of Kirovabadskaya Oblast.

Discovery and mastery of the Caspian Sea fields, including the Neftyanyye Kamni, Gryazevaya sopka, Peschanyy island, Darvina bay, Yuzhnaya, Bakhar in Apsheron archipelago and Sangachaly-more, Duvannyy-more Bulla island, Bulla-more, Garasu and others in the Baku archipelago, bears primary national-economic significance in the 30 years since the war.

General Secretary of the CPSU CC, Comrade L. I. Brezhnev, on visiting the offshore oil fields in 1970, highly esteemed the self-sacrificing labor of the offshore oil workers. He said: "The labor of the offshore workers is more than heroism!"

Successes in prospecting led to significant economic geographic changes in the oil recovery industry of Azerbaydzhan.

Prominent in significance are the offshore fields of the Caspian sea and the new oil and gas recovery regions of the cis-Kura depression; the proportion of fields of the cis-Caspian and Gobustan regions has increased.

Azerbaydzhan geologists face new, even more complicated problems in discovering new oil and gas resources. Clearly, when Baku fields long exploited at a high use factor for the active commercial reserves are involved, the possibilities of discovering new major fields and deposits are more limited than in the young oil and gas regions of the country.

Over the long years of prospecting in the continental part of the republic, most fields and deposits confined to relatively shallow depths and in regions with less complex geologic structure were discovered and transferred to the national economy. The remaining unfound reserves are at depths of 5000-6000 m and have more complex geologic and geomorphologic conditions.

Further effective prospecting demands heavy capital investments, profound scientific analysis of the structure of strata and correlations of oil and gas segregations and formation of deposits, as well as the wide use of all modern achievements in scientific-technical progress in the methodology and techniques of exploratory-prospecting and geophysical operations.

From these prerequisites, the Azneft' Association in recent years has been paying special attention to all-out increases in the effectiveness and improvement of all kinds of geological prospecting, concentrating it in the most promising scientifically valid directions and putting into prospecting and geophysical practice the most forward-looking technical advances. The positive results of these efforts are to be seen in some summaries of prospecting work in the Ninth Five-Year Plan. Over this time, new oil and gas deposits were discovered in the cis-Kura depression, along with new oil and gas-bearing tectonic blocks in the worked deposits of Kyurovdag, Karabagly, Neftechala and Kyusangya-severnaya; the new Kyursangya-yuzhnaya field was found.

Oil deposits of the Zagly-Zeyva field were found in the northwest Siazanskaya monoclinal. The discovery of the new Muradkhanly field in the Middle-Kura depression is fundamental in importance. This field is a type of segregation new to Azerbaydzhan. Its petroleum presence ties in with the porous-fractured reservoirs of the buried prominence of effusive formations of the Upper Cretaceous and sedimentary rocks of Paleogenic-Miocene age enveloping them. Earlier, commercial petroleum was obtained here from a series of wells at depths of 3800-3000 m. This year new data were acquired that once again confirm the field's potentialities.

Well number 58 is worked from a depth of 2980 m. Well number 56 is flowing steadily from the same site.

Coping with the awesome challenges set before the oil industry by the 25th CPSU Congress demands from Azerbaydzhan's oil prospectors a continued rise in the effectiveness and quality of geological prospecting and the all-out introduction of scientific-technical progress in prospecting drilling and deposit and field geophysics.

Most immediate of the on-land geologic challenges in Azerbaydzhan are:

the fastest possible culmination of mapping and initial exploitation of the Muradkhanly field, in the Middle-Kura depression--the first-priority object of prospecting; broad development within the entire region of geophysical investigations and prospecting and parametric drilling in searching for new analogous fields and deposits in the Paleogenic and Mesozoic

simultaneous stepping up of regional geophysical and drilling operations at these deposits in neighboring regions of Central and Western Azerbaydzhan

culmination of final prospecting of the entire profile of the production strata in the tracts of the Lower Kura depression as well as a step-up in searching for stratigraphic deposits in the southwest bordering parts of its development

intensifying of prospecting in tracing the Miocene-Oligocene, Paleogene and Mesozoic deposits in the northwest Siazanskaya monoclinal; faster regional operations, first of all, with geophysical methods, for the remaining part of the Kubino-cis-Caspian region for the purpose of reliably studying its structure and scientifically generalizing all the accumulated material for a more confident selection of first-priority drilling sites

extension of scientific research and exploratory-prospecting regional operations and, on their basis, parametric and exploratory drilling in the deposits of the Mesozoic in Adzhinour, Gobustano-Shemakhinskaya and Kirovabadskaya regions and others.

Attention of geophysical organizations must center on giving more help in coping with the serious tasks in studying the multiplane tectonics of the

promising foothill zones of the Greater and Lesser Caucasus (Gobustan, Adzhinour, confluence of the Kura and the Iora, the cis-Caspian depression and so on), as well as the plutonic structure of the depression regions and the intermontane troughs (Apsheronskaya, Lower and Middle Kura, Kirovabadskaya Oblast and others).

Heavy demands are imposed on the scientific research organizations of Azerbaydzhan for a sharp step-up in the scientific-theoretical and fundamental geological investigations, working out an optimal method of exploratory prospecting in the complex conditions of oil and gas deposits, including a new type of deposits differing widely from the well-studied classical deposits of the stratal and anticlinal types, correlations of oil and gas segregation in these conditions and so on.

Solving these problems will enable land-based oil workers in the Tenth Five-Year Plan period to expand prospecting of Azerbaydzhan's subsurface wealth, where there are undiscovered deposits of oil, condensate and gas.

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VOLGA-URAL OIL, GAS PROVINCE SET USSR RECOVERY RECORDS

Moscow NEFTEGAZOVAYA GEOLOGIYA I GEOFIZIKA in Russian No 10, Oct 77 pp 11-14

[Article by R. O. Khachatryan, Institute of Geology and Development of Mineral Fuels: "Role of Volga-Ural Province in Preparing the Raw-Material Base of the USSR Oil Recovery Industry"]

[Text] Forming and developing the Volga-Ural oil and gas province is a glowing page in the history of the social-economic upsurge of our country after the Great October Socialist Revolution. In the first years of the young Soviet state, V. I. Lenin put forward as a most important task the struggle with the fuel crisis and directed the thoughts and energies of geologists in searching for new deposits of mineral fuels within the country. In eliminating the grave situation in the country's power supplies, the new oil-bearing regions gained special significance. As directed by V. I. Lenin, the attention of the geologists was first centered on the Ural-Volga regions. Here on I. M. Gubkin's initiative, as far back as 1919, special geologic expeditions began searching for petroleum.

At the outset surface signs of oil presence in the regions of the Volga underwent detailed geologic examination. Tar sands of Permian age were studied in many sites (Fikov Kolok, Barskiy Batras, Nizhnyaya Karmalka, Sarabikulovo, Shugurovo, Degtyarnyy Ovrag, Kamyshla and others). K. P. Kalitskiy believed that here thick, gas-free liquid petroleum could be found and that the wells would be low in productivity. In justifying the high promise of oil presence in the regions of the Urals and the Volga, I. M. Gubkin, M. E. Noinskiy, A. N. Rozanov and A. D. Arkhangel'skiy based their thinking on the secondary nature of the numerous oil shows (presence of asphalt, tar sandstones and bitumens) in Permian rocks, whose source--in their opinion--were the oil deposits in the Devonian and Carboniferous beds, exhibiting the ability of petroleum formation on a regional scale.

In 1928, an organization under the Moscow Division of the Geological Committee of the Special commission studying oil and gas presence in the Urals-Volga area, chairmanned by I. M. Gubkin stimulated exploration for petroleum. On studying the material on the geology and oil shows, the commission concluded that searching for petroleum should go on, a finding with which by no means all the geologists were in agreement.

As we know, in 1929 in the Perm' cis-Ural area, near Chusovskiye Gorodki, the first oil gusher from the Lower Permian sandstones showed the presence of commercial deposits and announced the birth of a new, the Volga-Ural oil and gas province.

This discovery promoted during the years of the First Five-Year Plan (1929-1933) the expansion of the search for oil fields in the cis-Ural and Volga areas. In 1932 exploratory efforts were climaxed with a new triumph--the finding of oil deposits in the Lower Permian limestones of reef origin in the Ishimbay region. Exploratory drilling was carried out chiefly (more than 90 percent) in the Permian deposits in the cis-Ural area (Cherdyn', Krasnoufimsk, Gubakha-Kisel, Ishimbay and others) and to a much smaller extent in the western areas directly in the Volga area.

In determining the salient directions of searching for oil fields, enormous significance lies in the studies of A. D. Arkhangel'skiy, I. M. Gubkin, M. E. Noinskiy, D. V. Nalivkin and A. N. Rozanov. During these years, practical activities were faced with the problem of drilling wells in Carboniferous deposits beeded at accessible depths.

During the Second Five-Year Plan (1934-1938) began oil recovery mainly in the fields of the Ishimbay region of Bashkir ASSR and the center of gravity was shifted to searching for oil in the Carboniferous deposits. In 1936 oil deposits were discovered in the Verean horizon of the Middle Carboniferous in Krasnokamsk; a year later--in the Bobrikovskiy horizon of the Lower Carboniferous in the Syzranskoye and Tuymazinskoye fields and in the Kazanskiye deposits of the Upper Permian of the Buguruslanskoye field. An oil deposit was found for the first time in the limestones of the Tournaisian field in 1938.

Enthusiasm and great persistence in exploratory work in the cis-Ural areas were manifested by A. A. Blokhin and P. I. Preobrazhenskiy and in the areas of the Volga and the trans-Volga--by K. R. Chepikov. Wells striking the first oil deposits were drilled on their recommendations.

Thus, for the first decade after the Great October practice demonstrated the correctness of the views of the ranking geologists on the presence of liquid oil in the strata of the Ural-Volga area, which was of fundamental importance. This made it possible to raise as one of the most important economic problems of the Third Five-Year Plan the task of setting up a new oil and gas recovery base in the eastern part of the European part of the country--the Second Baku.

During the prewar years in the then-known oil-bearing regions, new fields continued to be discovered with oil deposits in the Carboniferous and Permian deposits; the first gas deposits were discovered in the Saratov Volga area; in different regions (Syzran' and Ardatovka) Devonian deposits were tapped. Nonetheless, oil recovery rose at slow rates and as a whole in the Ural-Volga area in 1940 its level had not yet come up to 2 million tons. Analysis and generalization of the factual material accumulated to that time enabled I. M.

Gubkin and other investigators to state a series of theoretical principles on the lithologo-facies, geochemical and tectonic conditions of formation and segregation of petroleum and to formulate the criteria of the scientific forecasting of the oil and gas presence of Devonian and Carboniferous deposits.

The very special importance of the Volga-Ural province was felt in the Great Patriotic War, when the army began to be supplied with petroleum products from the eastern regions of the country on an ever-increasing scale. During these years setting up the new oil and gas recovery base in the Ural-Volga area went on at more intensive rates and was crowned by the discovery of oil fields in the new regions, particularly in the Tatar ASSR (Shugurovskoye), in Saratovskaya Oblast (Yelshanskoye, Peschano-Umetovskoye, Irinovskoye and others). However, the most significant result was the discovery in 1944 of the first high-output oil deposits in the sandy-aleurolite strata of the Givetian and in the lower part of the Frasnian stage of the Devonian; in July in the Yablonovoovrazhnoye field in Kuybyshevskaya Oblast and in September at the Tuymazinskoye field in Bashkiria. Discovery of oil deposits in the Devonian terrigenic deposits was the turning point in setting up a mighty raw material base in the Volga-Ural province, ensuring the subsequent rapid growth in oil recovery in the country.

Predicting the high prospects of the Carboniferous and especially the Devonian deposits was fully justified by the results of exploratory-prospecting works widely stepped up in the postwar years in the Fourth Five-Year Plan. Soon the Bavlinskoye (1946) and the Romashkinskoye (1948) fields in the Tatar ASSR were discovered, along with the Serafimovskoye (1949) and other fields in the Bashkir ASSR, Archedinskoye (1949) and Zhirnovskoye (1950) fields, laying the foundation for the expansion of the oil and gas industry in yet another region of the Volga area--Volgogradskaya Oblast. Since this period, the Volga-Ural province was advanced to first place in the country in terms of proven oil reserves; this made it possible in 1950 to recover here more than 10 million tons of oil, substantially raise the level of recovery for the country as a whole and to prepare the prerequisites for its accelerated growth in the future.

Starting in the Fourth Five-Year Plan, the raw-material base of oil recovery in the Volga-Urals region steadily consolidated. The systematic, planned growth in the commercial reserves of oil and gas is a hallmark of this province.

Oil reserves were heavily added to in the Fifth Five-Year Plan period (1951-1955) not just by prospecting earlier-discovered fields, but also through finding new oil deposits in Devonian and Carboniferous deposits in the following fields: Shkapovskoye and others in the Bashkir ASSR, Aktashsko-Novoyelkhovskoye, Bondyuzhskoye and others in the Tatar ASSR, Gozhanskoye and Kuyedinskoye in Permskaya Oblast and Stepnovskoye and General'skoye in Saratovskaya Oblast. The raw-material base was particularly built up in Kuybyshevskaya Oblast through increments in oil reserves in the Devonian and Carboniferous deposits in the Mukhanovskoye, Dmitrovskoye and other fields, as well

as in Volgogradskaya Oblast, where the Korobkovskoye and Bakhmet'yevskoye gas and oil fields were discovered. In 1955 oil recovery in the Volga-Ural province was more than 41 million tons; this enabled it to rank first in the Fifth Five-Year Plan among other oil and gas-bearing provinces of the country.

A new long stride in the expanded augmenting of oil reserves was completed in the Sixth and Seventh Five-Year plans. Discovery of entire zones of oil and gas segregation (Yarino-Kamennolozhskaya, Batyrbayskaya, Kylasovo-Veslyanskaya and others) materially increased the oil reserves in Permskaya Oblast, where its recovery began rising rapidly. Finding the Arlano-Dyurtyulinskaya, Mancharovo-Karazirikskaya and other zones of oil and gas segregation in Bashkiria and in Kuleshovskaya Oblast and others in Kuybyshevskaya Oblast, Pokrovsko-Rodinskaya and Bobrovskaya--in Orenburgskaya Oblast, Chutyrsko-Kiyengopskaya in Udmurtia, as well as many fields in other oil and gas-bearing regions of the province ensured for the Volga-Ural province the ranking place in the country as to increments in reserves of commercial-category oil. The larger part of the increment in oil reserves came from Carboniferous deposits. In all these regions, particularly in the Tatar and Bashkir republics, as well as in Kuybyshevskaya and Permskaya oblasts, oil recovery grew steadily; overall for the province, in 1960 it was 104.5 million tons, that is, 2.5 times greater than at the close of the preceding five-year plan period; in 1965, it was 173 million tons. In these years 75 percent of the countrywide recovery of oil came from fields of the Volga-Ural province.

Searching for oil kept up over a broad front in the Eighth and Ninth Five-Year plans. Paramount directions of exploratory and prospecting work were fixed by established correlations of the location of oil fields. These correlations were used most adeptly in the scientific substantiation of the search for oil deposits in the Kamsko-Kinel'skaya system of troughs.

During the Ninth Five-Year Plan period, the larger part of the increment in oil reserves of commercial categories came from Carboniferous deposits that were part of the structure of the Kamsko-Kinel'skiye troughs. Searching for deposits in the troughs of this system was particularly successful in Permskaya and Orenburgskaya oblasts, as well as in Udmurtia, which from the close of the sixties became yet another new oil recovery region of the Ural-Volga area.

In the last decade, also productive was the scientifically very well-argued searching for oil deposits containing finds in the Givetian-Lower Frasnian terrigenic deposits of the Devonian, confined to the local uplifts in the marginal zones of the narrow grabenlike troughs. Discovery of the Sergiyevsko-Demskaya, Tavtimanovo-Beketovskaya and Urshakskaya zones of oil and gas segregation in Bashkiria not only confirmed the reliability of the scientific predictions, but also evidenced the need to search for analogous zones in other regions of the provinces as well--in Orenburgskaya, Kuybyshevskaya and Permskaya oblasts.

On the discovery of the Orenburg gas condensate field in the European USSR, the gas recovery industry commenced developing at a brisk tempo in the province.

Over the Eight and Ninth Five-Year plan periods oil recovery in the province steadily grew and by late 1970 was more than 208 million tons; in 1975, the amount recovered reached the maximum level (nearly 225 million tons). In the Volga-Ural province more oil was recovered than in any other oil and gas-bearing province of the country, though the proportion by the close of the Ninth Five-Year Plan period dropped to 45 percent because oil recovery accelerated in Western Siberian regions. As for the conditioning of the commercial oil reserves, in spite of their increment in the past two five-year plan periods this province gave way to regions in Western Siberia.

Thus, the role of the Volga-Ural province in conditioning the reserves for the growth of the oil recovery industry of the country has been extraordinarily striking. Thanks to the discovery and mastery of oil and gas wealth in the Ural-Volga area, energy sources came to be found closer to the primary industrial centers of the country; this made it possible to set up here a mineral and raw-material base for organizing a series of new industries of the national economy and therefore promoting the more balanced siting of the country's productive forces. It is specifically the growth in oil recovery in this province that led to the Soviet Union becoming one of the major petroleum countries of the world as long ago as the 1950s.

The Volga-Ural oil and gas-bearing province is characterized as a whole by a fairly high degree of prospecting. Additionally, the province still has sizable possibilities for conditioning commercial oil and gas reserves. Concentrating exploratory and prospecting work in the most promising directions will ensure in the future an increment in oil reserves, with an entirely profitable economic geological effectiveness. Therefore, in celebrating the glorious 60th anniversary of the Great October Socialist Revolution, we can rest assured that in the Volga-Ural province are favorable prerequisites for keeping up for a long time the attained level of oil recovery in the European USSR. Meeting this challenge will make a heavy contribution to building the material and technical base of communism in our country.

10123
CSO: 1822

MISUSE OF PETROLEUM PRODUCTS AT KOLKHOZES

Moscow SOTSIALISTICHESKAYA ZAKONNOST' in Russian No 11, Nov 77 pp 75-76

/Excerpt/ The Prosecutor's Office of Volynskaya Oblast has taken measures to eliminate the established violations of legislation on the safekeeping of petroleum products at kolkhozes.

The Prosecutor's Office of Volynskaya Oblast organized at a number of kolkhozes of the oblast a check of the observance of the laws on the sakekeeping of petroleum products.

It was established that the requirements of the party and government on the economical consumption of fuel resources were not being met at some kolkhozes.

Cases of mismanagement and the squandering of fuel and lubricants were discovered. During 1976 and the first quarter of 1977 the kolkhozes of five rayons of the oblast sold to enterprises and organizations 924.7 tons of gasoline, 547.1 tons of diesel fuel and 11 tons of lubricants worth a total of more than 136,000 rubles.

While selling fuel and lubricants on the side, the kolkhozes of the oblast at the same time received at the bases of the oblast Sel'khoztekhnika Association more petroleum products than were allocated to them according to the norms, including 3,781 tons of gasoline and 5,339 tons of diesel fuel.

As a rule, the enterprises and organizations bought the fuel and lubricants at the kolkhozes in exchange for construction, industrial and other centrally allocated materials which are in greater demand, by which they violated state planning discipline. For example, in exchange for gravel and other construction materials the Rozhishche Road Department in 1976 purchased at the Kolkhoz imeni Engels of Rozhishchenskiy Rayon 21 tons of gasoline and 26.4 tons of diesel fuel.

For some enterprises and organizations the kolkhozes have become one of the main sources of their supply with fuel and lubricants. During last year

and the first quarter of this year alone the Rozhishche Reinforced Concrete Items Plant purchased at seven kolkhozes of Rozhishchenskiy Rayon about 100 tons of diesel fuel for stoking furnaces. The Lutsk Instrument Making Plant, the Novovolynsk Reinforced Concrete Items Plant and Ore Repair Plant, the Kovel' Flax Plant and a number of other enterprises regularly purchased gasoline and other fuel and lubricants at kolkhozes.

Sh., the chairman of the Radyans'ka Ukraina Kolkhoz of Kivertsovskiy Rayon, by abusing his official position, without the knowledge of the board of the kolkhoz sold more than 95 tons of gasoline and diesel fuel in exchange for various construction materials to the Lutsk Road Repair and Construction Administration No 95, the rayon procurement office, the wood-processing combine and the interkolkhoz construction administration.

Cases of the wasteful storage of petroleum products were discovered at kolkhozes of the oblast. At the Kolkhoz imeni Kalinin of Kamen'-Kashirskiy Rayon the tank in which two tons of diesel fuel were stored was not covered, water got into it, the fuel could not be used as intended, it was carried to a field and burned.

This situation has formed at a number of kolkhozes of the oblast because the oblast and rayon agricultural administrations and the organizations of Sel'khoztekhnika have not exercised proper control over the economical and purposeful consumption of fuel and lubricants. And bank institutions have also not exercised proper control over the legality of operations on the sale by kolkhozes of fuel and lubricants to enterprises and organizations.

The Prosecutor's Office of Volynskaya Oblast, in the cases of the squandering of petroleum products by kolkhozes instituted a number of criminal proceedings and passed on the information to the oblast party committee.

7807
CSO: 1822

BRIEFS

SYRDAR'INSKAYA GRES--The sixth power block at the Syrdar'inskaya GRES, the largest thermal electric power station in Central Asia, was put into operation ahead of schedule. The collective of Syrdar'yagresstroy decided to turn over in excess of the plan during the anniversary year the seventh block as well. The initiative was supported by machine builders of Leningrad, Zaporozh'ye, Taganrog, Chelyabinsk, Belgorod, Alma-Ata and other cities, with whom the construction workers and installers are connected by firm business ties on the principles of "A Workers' Relay Race." /Text/ /Moscow STROITEL'NAYA GAZETA in Russian 16 Nov 77 p 2/ 7807

TATAR OIL--Al'met'yevsk--Half of all the oil in Tatariya is now produced using the wells drilled by the collective of the Al'met'yevsk Administration of Drilling Operations, one of the largest in the country. Recently it celebrated its 25th anniversary. During this time the average duration of the drilling of a single well in the administration was reduced from 144 to 21.7 days. It was possible to achieve such a reduction of the expenditure of time owing to the constant improvement of drilling technology and the introduction into production of powerful turbodrills, including three-section ones developed by administration engineers R. Ibatullin, T. Bikchurin and others. This innovation has presently been adopted in the equipment in many oil regions of the country. The development of a highly productive series of bits is also the merit of the Al'met'yevsk drillers. /Text/ /Moscow IZVESTIYA in Russian 13 Nov 77 p 1/ 7807

MEDVEZH'YE GAS--The oil field workers of the Nadymgazprom Production Association, who operate the Medvezh'ye deposit, the northernmost in our country, have produced the 50 billionth cubic meter since the beginning of the year. This store is the largest supplier of blue fuel in the country. Now about 197 million cubic meters of natural gas, including 16 million cubic meters above the plan, are daily sent to industrial centers from its depths. This year the collective of the Tyumengazprom Association will supply the national economy with more than 63 billion cubic meters of blue fuel. /Text/ /Moscow PRAVDA in Russian 18 Nov 77 p 1/ 7807

NOVOSIBIRSKAYA GES--The Novosibirskaya Hydroelectric Power Station, the largest in western Siberia, yielded the first industrial current 20 years

ago. In the time that has passed it has generated 35 billion kWt-hr of electric power. There works here a collective communist labor, which through the modernization of equipment and the introduction of rationalization proposals was able to increase considerably the capacity of the GES. /Text/ /Moscow PRAVDA in Russian 18 Nov 77 p 1/ 7807

NIZHNEVARTOVSK-KUYBYSHEV PIPELINE--Kuybyshev, 17 Nov--Two oil pumping stations, the Komsomolets and Yerzovka, owing to which the rate of delivery of Siberian oil to enterprises of Povolzh'ye and the Ukraine will increase sharply, have been built on the route of the Nizhnevartovsk-Kuybyshev oil pipeline. Construction Administration No 1 of the Vostoknefteprovodstroy fulfilled ahead of time the obligation of the anniversary year. /Text/ /Moscow PRAVDA in Russian 18 Nov 77 p 1/ 7807

KURPSAYSKAYA GES--Kirgiz SSR--The driving of the upper deck of the construction tunnel at the building of the Kurpsayskaya GES was completed two days ahead of schedule. The brigades of V. Yerofeyev and Sh. Sapparov drove its last meters. The hydraulic engineers had been moving toward each other for nine months. During this time thousands of cubic meters of rocky soil were removed. And now the 605 meters of the underground "bridge" are finished. A beachhead has been gained for the spanning of the Naryn, which will take place at the beginning of next year. /Text/ /Moscow PRAVDA in Russian 15 Nov 77 p 2/ 7807

ORENBURG-WESTERN BORDER PIPELINE--Bykovo, Volgogradskaya Oblast--The beams of spotlights lit up on the shore of the Volgograd reservoir. Literally drawing near a late autumn sunrise, the collective of the fourth specialized administration of the Soyuzpodvodgazstroy Trust began here, in the settlement of Bykovo, the laying of the third, the last thread of the Orenburg-USSR Western Border pipeline. It remains to ford more than 4 km of a water obstacle, the largest on the 2,750-km route of the international construction project. Experienced experts at their jobs have taken up the watch. A barge with a winch froze over the ditch, which was covered by a layer of water 30 m deep. Machine operator A. Krivosheyev turned on the machinery and, carried away by a strong cable, the first length of pipe moved toward the water. The entire collective of the route of friendship is working these days at a shockwork rate. On the Zavolzh'ye steppe the testing of the linear part of the giant pipeline is being completed. The Czechoslovak specialists woking in this section on the eve of the 60th anniversary of Great October reported the early fulfillment of the annual plan. They are also carrying out ahead of schedule the installation of the compressor station at Antipovka. /Text/ /Moscow IZVESTIYA in Russian 16 Nov 77 p 1/ 7807

HYDRAULIC GENERATOR STATOR--Novosibirsk--The collective of the Sibelektrotyazhmash Plant has completed the production of the hydraulic generator stator for the Nizhnekamskaya GES. This assembly weighs about 400 tons. But it is far from only a matter of the dimensions of this colossus: the generator was designed and produced with allowance made for all the achievements

of domestic and foreign electric machine building. Thirty such hydraulic generators will be delivered to the Nizhnekamskaya and Cheboksarskaya GES's, which are under construction. [Text] [Moscow IZVESTIYA in Russian 16 Nov 77 p 3] 7807

POWER LINE TOWERS--Nakhodka--Electric power transmission line construction crews, with the aid of a helicopter, performed an effective operation of installing on the tops of the hills surrounding the city nine towers for the high-voltage power transmission line which is under construction. With the aid of the helicopters they transported and erected towers at the most inaccessible sites along the new power transmission line. This high-voltage line, running approximately 3 kilometers, will link the new substation at the Nakhodka commercial port to the kray power grid. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 29 Nov 77 p 2] 3024

SYRDAR'INSKAYA GRES--The sixth power block of the Syrdar'inskaya GRES has been built. On the threshold of the new year the fires of the next, the seventh power block will flare up. And then the station will reach a capacity of 2.1 million kilowatts. Where the expanses of the famous Golodnaya Steppe and the shore of the Syrdar'ya merge, an earthly sun has begun to shine.... [Excerpt] [Moscow PRAVDA in Russian 10 Nov 77 p 2] 7807

TYUMEN' GAS IN KUZBASS--Kemerovo--Yesterday the Nizhnevartovsk-Parabel'-Kuzbass gas pipeline, the largest in Siberia, began operating. It was laid through nearly 1,000 km of forest, swamps and rivers. The furnaces of the Novokemerovskaya TETs were the first to receive Tyumen' gas. At a meeting of construction workers and power engineers, which took place here, it was noted that the conversion to operating on gas will permit this enterprise alone to save annually about 90,000 tons of coal, to considerably improve the working conditions of power workers and to improve the air basin. After the TETs other industrial enterprises of the Kuzbass will receive natural gas. But chemical and metallurgical plants will become its main consumers. At the Kemerovo Azot Association alone gas will make it possible to increase by two times the output of ammonia and mineral fertilizers and to appreciably decrease the production cost of products. It is intended to carry out the conversion of enterprises to natural gas at a rapid rate. Next year the Kuzbass will receive 3 billion m^3 of "blue fuel" from Tyumen'. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Nov 77 p 1] 7807

IONAVA FERTILIZER PLANT--Ionava--The large complex of weak nitric acid, which was started up at the Ionava Nitrogen Fertilizer Plant a quarter earlier than the deadline, produced its first products. It was planned to obtain them only at the beginning of next year. The operators were obliged to reduce the period of assimilation of the planned capacity of the new works, having achieved this mark in the space of three months. The collective prepared for a high rate of work already during the period of the installation of the equipment. Experienced operators of the already operating complexes of the enterprise decided to expand the zone of service of units, having ensured the high productivity of new equipment. The complex of weak nitric acid is an important link of the third section of the plant. It is planned to complete its construction this year. The adjustment of

equipment for the production of nitrofoska and ammonia is now rapidly taking place. During the installation innovators made a number of improvements which will make it possible to decrease the periods of the assimilation of production capacities. Already next year the rural workers will receive from Ionava about 1.5 million tons more of mineral fertilizers. /Text/ /Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Nov 77 p 1/ 7807

KOMI OIL--Ukhta--More than 80 new wells were put into operation ahead of time since the beginning of the year at the deposits of the Komineft' Association. This is nearly two times more than stipulated by the plan. The rapid assimilation of new capacities at the enterprises of the associations is being combined with the efficient use of wells. The production of oil at the Usinsk, Western Tebuk and Pashninskiy deposits is being carried out only by the advanced free-flow method. Today the oil workers of the republic fulfilled ahead of time one of the main points of the higher annual obligations. The 400,000th ton of above-plan oil since the start of the year was sent to the center of the country. /Text/ /Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Nov 77 p 1/ 7807

URALMASH EXCAVATOR--Sverdlovsk--The collective of Uralmash has produced a new powerful walking excavator, the ESh40/85. It is being installed at the Azeyskiy coal pit. The machine is intended for carrying out stripping according to a transportless operating schedule. This is the least expensive and most efficient system of all the currently existing stripping methods. The capacity of the bucket of the walking giant is 40 m^3, while the length of the boom is 85 m. The excavator can operate over a temperature range of +40 to -40 degrees. All the best from domestic heavy excavator building was used in its designing. In comparison with the ESh25/100 the annual productivity of the new machine is 70 percent higher. The weight of the ESh40/85 per unit of capacity of the bucket is 25 percent lower than for machines of the same class. The excavator is equipped with auxiliary hoisting mechanisms for repair and service within the motor room and an overhead crane with a lifting capacity of 20 tons. The cab has sound and heat insulation and is equipped with air conditioning. In the cab there are an adjustable seat and a refrigerator for storing food. The annual economic impact from the use of one such new machine exceeds 500,000 rubles. /Text/ /Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Nov 77 p 2/ 7807

UNDERWATER CABLE--The Leningrad Sevkabel' Association for the first time in our country laid an underwater cable 1.5 km in length without a single splice. Several such unique conductors with a tension of 110,000 V will be laid at the bottom of the Gulf of Finland from Vasil'yeskiy Island to Belyy Island. This powerful power line will provide the necessary power to a complex of purification structures, which is being built. The laying of the underwater cable line will begin unusually--directly from the plant territory and will pass through three pipes more than 200 mm in diameter. The designers and production workers have been concerned about the high quality and reliability of the new cable, which has a "jacket" made of more than 100 layers. /Text/ /Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 Nov 77 p 2/ 7807

CSO: 1822

APPLIED SCIENCE CONFERENCE ON EDUCATION HELD

Moscow UCHITEL'SKAYA GAZETA in Russian 6 Dec 77 p 1

/Article: "The Conference Has Concluded"/

/Text/ The All-Union Applied Science Conference "Problems of the Integrated Realization of the Tasks of Communist Education in Light of the Decisions of the 25th CPSU Congress" was held in Moscow on 3 December. The conference proceeded under the profound impact of the greeting addressed to the participants by the General Secretary of the CC CPSU and Chairman of the USSR Supreme Soviet Presidium, Comrade L. I. Brezhnev.

The conference participants thoroughly analyzed the problems of party organizations' theory and experience on shaping the scientific world view and communist ideology and on developing the high labor and political activity of the Soviet people. The participants considered the work practice of ideological institutions on realizing an integrated approach to the education of the workers in light of the decisions of the 25th CPSU Congress, the subsequent CPSU CC plenums, and the reports and speeches of Comrade L. I. Brezhnev.

On the concluding day the following sections operated at the conference: "The Unity of Ideological and Political, Labor, and Moral Education," "The Unity of the Economic, Socioeconomic, and Ideological Factors of Education," "A Consideration of the Specific Features of Real Population Groups in Educational Work," "The Integrated Use of the Means of Communist Education," and "Improving the Planning and Organization of Educational Work."

The following secretaries of the union republic Communist Parties spoke at the concluding plenum: S. N. Imashev, Kazakhstan; L. K. Shepetis, Lithuania; and V. I. Vyalyas, Estonia. Also speaking were the secretary of the Leningrad Oblast CPSU Committee, B. S. Andreyev, and the deputy director of the Marxism-Leninism Institute attached to the CC CPSU, M. V. Mchedlov.

V. V. Grishin, a member of the Politburo of the CC CPSU and first secretary of the Moscow Municipal CPSU Committee delivered the concluding speech.

The conference participants adopted with great enthusiasm Comrade L. I. Brezhnev's salutatory letter. Party organizations and ideological employees, the letter reads, are aware of their responsibility for the state of affairs at such an important sector of the struggle for communism as ideological and educational work. Relying on the Leninist ideological legacy and broadly using the theoretical wealth accumulated by our party and practical work experience, the conference participants stressed, we shall continuously improve the forms and methods of the communist education of the workers and achieve the realization of the plans of the 25th CPSU Congress and the assignments of the Tenth Five-Year Plan.

The participants of the All-Union Science Conference assured the party Central Committee, the Politburo of the CPSU CC, and Comrade L. I. Brezhnev personally that they would apply every effort and all their experience and knowledge to carry out the tasks posed by the party.

The following individuals participated in the proceedings of the concluding meeting: A secretary of the CC CPSU, M. V. Zimyanin; two heads of CPSU CC sections, Ye. M. Tyazhel'nikov and V. F. Shauro; responsible employees of the party CC and Moscow Municipal CPSU Committee; secretaries of the Central Committees of union republic Communist Parties and kray and oblast CPSU committees; heads of ministries and agencies and public organizations; national economic specialists; ideological employees; scientists; and literary and art figures.

7094
CSO: 1822

GROWTH PROSPECTS OF SECONDARY VOCATIONAL, TECHNICAL EDUCATION DESCRIBED

Moscow UCHITEL'SKAYA GAZETA in Russian 13 Dec 77 pp 2-3

/Article by S. Batyshev, acting member of the USSR Academy of Pedogogical Sciences: "Growth Prospects"/

/Text/ Scientific-technical progress is closely connected with educating the new man and with systematically supplying the national economy with highly skilled workers. These are not the skilled craftsmen of former times, but educated individuals knowing the production principles of a given industrial sector.

What is now characteristic of the workers of many occupations is the performance of not only their traditional functions. Now, according to statistical data, over half of all workers have two and more specialties and occupations. Whereas there were over 30,000 occupations in the USSR before 1962 and over 12,000 in the 1960's, today there are nearly 6,500. The rapid integration of occupations is taking place: Some disappear, some of the leading ones become secondary, and new ones appear. Today the highly skilled worker servicing an automatic line should possess high-caliber technical thought and the ability to look into complex physical and technical processes and kinematic and power-engineering schemes, to analyze the course of a technologic process, and to solve the problems of a technical diagnosis and forecast on time. These are the workers that secondary vocational and technical schools are called upon to train. There are over 3,000 such schools in the country today. They have gained general recognition in a brief time. It is not fortuitous that selection based on competition is effected for admission to many secondary vocational and technical schools.

A characteristic feature of this type of educational institution involves combining vocational training with general secondary education. The mastery of an occupation and the principles of the sciences therein constitutes a unified instructional procedure: General education subjects serve as a base for studying general technical and special disciplines, and the latter help strengthen knowledge in the general education subjects and supplement and extend them. Moreover, students have the possibility of applying the obtained

knowledge in practice. Such organization of educational work enhances the quality of training, vocational instruction, and vocational education. Studies show that secondary vocational and technical school graduates work 5 to 6 percent more productively than do boys and girls who graduate from the usual vocational and technical schools and 15 percent more productively than do those who obtain an occupation directly on the job. Young workers who have gotten a secondary education along with a vocation increase their skills 3 times as rapidly as do their peers and participate in the technical and organizational improvement of production more actively.

A vocational specialty obtained by youth in secondary vocational and technical schools virtually excludes mistakes in selecting the configuration of specialisms of a tekhnikum or a higher educational institution in case of further education.

The prerequisites for the development of vocational and technical education are the numerical growth of the working class, especially highly skilled workers, as well as the increased requirement for worker cadres. The working class, according to estimated data, will total 75 million in 1980 and 79 million in 1990. This being the case, qualitative changes will take place in the occupational structure: There will be an increase in the share of highly skilled workers -- to 89 percent in 1990. All this requires the steadfast strengthening of secondary vocational and technical schools. Today they already account for 55 percent of the total number of vocational and technical schools. By 1980 this proportion will increase to 85 percent. The growth of secondary vocational and technical schools is the general line for the development of vocational and technical education and the shaping of the young generation of the working class. Through this, the vocational and technical education system is making its important contribution to completing the transition to universal secondary education in our country.

What are the prospects for the further improvement of the instructional procedure in secondary vocational and technical schools? Vocational and technical education employees must know what our enterprises will be within, say, 5 to 10 years and more; what new vocations will be required by our production; and what level of knowledge, skills, and abilities the workers have to have to do their work in a skillful way. That is why long-term plans for the development of secondary vocational and technical schools and the content of their work must be interconnected with the long-term comprehensive plans for the development of both enterprises and sectors as a whole. Indeed, this is also understandable: With an improvement in production, there should also be an improvement in the structure of worker cadres.

A basic way to further improve vocational and technical education involves the scientific substantiation of educational plans and programs. This being the case, it seems advisable to do this work along two lines: First, the improvement of the currently operating study plans and curricula and, second, the development of fundamentally new study plans and curricula and their experimental verification, with due regard for the vocations being studied

and for a differentiated approach to the general education training of students.

A characteristic feature of scientific-technical progress is expanded standardization, the commonality of units, assemblies, various devices, machine and equipment parts and elements, power sources, and the laws of their application. For instance, industry has a large variety of machine types; however, they are similar and are always based on common characteristics: The same electronic computers for the comprehensive automation of the control of production processes are applied in the metallurgical, chemical, processing, and other sectors. The commonality of the scientific-technical principles of various occupations imposes homogeneous demands on general educational, general technical, and overall special training. This assumes a fundamentally new basis for the training of highly skilled workers. The essence of the new approach, as studies have shown, lies in the fact that the entire training process is divided into two stages -- the basic and the special. On the basic, which occupies nearly 85 percent of all study time, the foundation of training is layed, and broad vocational and polytechnical training is effected. This training is not subjected to rapid changes under the impact of scientific-technical progress.

Here the students acquire the most typical knowledge, skills, and abilities characteristic of all industrial sectors.

Broad vocational and polytechnical training on the basis of the training stage will instill into the students the ability to shift from one type of activity to another, in accordance with the rapidly changing production conditions and the methods for work performance. This part of the program may remain constant for 10 to 15 years and more and should be elaborated on a centralized basis and applied to all secondary vocational and technical schools as an obligatory document in studying specific groups of vocations.

In the special stage of training, the students acquire on the basis of general vocational and polytechnical training the knowledge, skills, and abilities applicable to the study of concrete specialties and to the performance of specific types of work. This part of the program takes up about 15 percent of all study time and is subject to more rapid changes under the impact of scientific-technical progress (3 to 5 years). Therefore it should be worked up at the places of the organs of vocational and techncial education as applied to production conditions, at the places where the students go through on-the-job training and will work following graduation from a secondary vocational and technical school.

The new approach to training highly skilled workers is also connected with the preparation of new textbooks. We are of the opinion that the creators of didactic means and technical complexes, hygienists, and methods specialists should also participate in this process.

Curricula and textbooks should also reflect educational problems. Educational goals and tasks must also be clearly formulated in terms of their vocational

and skill characteristics. These documents ought to devote more attention to problems of ideological and political, labor, and moral education, to the inculcation of communist conviction into students, and to the shaping of high moral qualities, a conscientious attitude toward labor and public property, and readiness to protect and increase the revolutionary and labor traditions of the working class by all that is holy.

There are general laws governing the expansion and improvement of the knowledge of current and future workers. The difference lies solely in the fact that the extent of general educational, general technical, and special knowledge will differ for various groups of occupations. For instance, the adjuster of a metal-cutting lathe is likely to need less knowledge about biology and even chemistry; on the other hand, he is obligated to have a greater knowledge of physics and mathematics. Just as the animal husbandry worker must obviously have a greater knowledge of biology. Consequently there arises the necessity for a more profound study of general education subjects connected with future production activity. This is also important because many themes of subjects of study egress at the special technology of a specific vocation. This gives rise to the task whereby instructors need to master the natural and mathematical cycle of the knowledge of the principles of the production equipment and technology of the basic enterprise, which situation will afford them an opportunity for realizing the vocational direction in the teaching of general education subjects.

This also gives rise to another important task -- that of the acceleration of the process of the specialization of secondary vocational and technical schools. It has now become quite obvious that with multispecialty training, instructors are unable to carry out the teaching process at a high level, since they are not in a position to know several industrial sectors. Therefore the specialization of vocational and technical schools is a problem of state-wide significance.

The highly skilled worker should know profoundly the production principles of a given industrial sector and master the elements of engineering and technical training. Additional demands are therefore imposed on his training.

Let us assume we need to train a repairman to service an automatic line. His theoretical training should accord with the highest scale of charges -- the sixth grade -- and his production training should be two to three grades lower. Such theoretical training of a worker will markedly expand his technical horizonand create conditions for the rapid growth of occupational skills in production following school graduation without additional course training. This growth may accelerate markedly if training in the secondary vocational and technical schools is organized on the basis of the experience of production innovators. Allusion is to apprentices' occasional acquaintance with advanced experience and to the creation of a system for the study of the best labor methods and for their introduction into practice.

Arriving in production, the graduates of secondary vocational and technical schools will themselves become the conductors of all that is new and advanced.

The exigency and complexity of the problems of improving the teaching and instructional procedure in vocational and technical schools determine the necessity for comprehensive studies. To this end, the Vocational and Technical Pedagogics Department of the USSR Academy of Pedagogical Sciences has drawn up a coordinated plan of scientific-research work that takes in over 100 scientific-research institutes, ministries, and agencies and over 50 divisions, laboratories, sectors, and individual groups. In realizing this plan, an important role is allotted to the All-Union Scientific-Research Institute of Vocational and Technical Education. The Scientific-Research Institute of Vocational and Technical Pedagogics set up in Kazan' has also been connected with these studies. The scientific substantiation of the training of highly skilled workers is an important condition for further developing vocational and technical education.

The recently adopted decree of the CPSU CC and the USSR Council of Ministers "On Further Improving the Process of Instructing and Educating the Students of the Vocational and Technical Education System" will undoubtedly play an important role in improving the training of young workers and have it meet the most up-to-date demands.

7094
CSO: 1822

EDUCATION OF YOUNG WORKERS FOR OCCUPATIONS STRESSED

Moscow EKONOMICHESKIYE NAUKI in Russian No 10, Oct 77 pp 95-103

[Article by Candidate of Economic Sciences Ye. Zhil'tsov: "Raising the Cultural-Technical Level of Workers During the Years of Soviet Power"]

[Text] In embarking on the building of a socialist society, the Communist Party and the Soviet people were governed by V. I. Lenin's instruction that anyone taking up the building of a new society must understand that "...it can be created only on the basis of modern education and that, if it does not master such education, communism will remain only a wish."[1]

The necessity of effective and accelerated measures to raise the cultural-technical level of the workers after victory of the socialist revolution had a number of causes. This was demanded by economic conditions, foremost the solution of the task of creating the material and technical base of the new society. Elevating the educational and occupational level of the workers was both a mandatory prerequisite for and simultaneously a consequence of the development of social production and increasing labor productivity. In order to ensure substantial development of production transferred to the path of socialism in a brief historical period, it was necessary to have this mandatory prerequisite. Raising the cultural-technical level of the workers resulted from the action of the basic economic law of socialism, from the necessity of meeting ever more fully the material and spiritual needs of the people, of the free and comprehensive development of all members of society, of shaping the harmonious personality.

Soviet authority inherited from prerevolutionary tsarist Russia an extremely low level of education in the population. "So savage a country, in which the masses of people have been so robbed in the sense of education, society and knowledge," wrote V. I. Lenin, "no country in Europe is so savage in this way as is Russia."[2]

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1. V. I. Lenin "Poln. sobr. soch." [Complete Collection of Works], Vol 41, p 307.

2. V. I. Lenin "Poln. sobr. soch.," Vol 23, p 127.

In prerevolutionary Russia, 75 percent of the population (60 percent of men and 83 percent of women) ages 9 to 49 were illiterate. Four-fifths of all children and adolescents did not attend school. Illiteracy was particularly high in rural areas. Many peoples and nationalities in outlying districts of prerevolutionary Russia were illiterate almost to a man; 48 nationalities had no written language. On the eve of the revolution, tsarist bureaucrats determined that 100-150 years would be needed to effect universal primary education. Opportunists asserted that socialism could not be established in Russia due to the low level of education and culture of the population. V. I. Lenin's great service is that he substantiated the principle of the proletariat's winning political power in a country with a low level of education as a necessary prerequisite to and guarantee of rapid rise in the cultural and technical level of the entire people.

Actualization of the plan for electrification of the country worked out on V. I. Lenin's initiative and under his leadership was linked inseparably in his mind with raising the cultural-technical level of the workers. Thus, in speaking at the 3rd All-Russian Komsomol Congress, V. I. Lenin emphasized: "You are thoroughly aware that electrification does not suit illiterate people, and simple literacy alone is not even enough."[1]

Growth in the cultural-technical level of the workers was also needed in connection with the nature of the political superstructure of socialism. By its very nature, it needs high activeness and awareness among broad masses of workers, for it arises and is developed as their living creation. But the role of the laboring masses, and the working class first of all, in building the new society cannot grow and the participation of working people in managing state and economic affairs of the country if these people remain at the same level of education and culture found by the victorious October Revolution. "The illiterate person," V. I. Lenin pointed out, "stands outside politics."[2] V. I. Lenin viewed nationwide literacy as an essential condition for developing the political consciousness of the working masses, for arousing them to active political life. Vladimir Il'ich emphasized that a thorough mastering of the concepts of communism and the shaping of a Marxist world view must rely on all the achievements of human culture, on studying the principles of natural and social sciences, and must be combined with the ability to make practical use of the knowledge gained.

Raising the cultural-technical level of the workers also results from the fact that it creates a base for further growth in spiritual needs, for the active participation of people in cultural life. Growing education is an important method for developing personality and is an independent spiritual value.

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1. V. I. Lenin "Poln. sobr. soch.," Vol 41, p 307.

2. V. I. Lenin "Poln. sobr. soch.," Vol 44, p 174.

Raising the cultural-technical level of the population is also dictated by the tasks of social progress which, in particular, plays the role of an important factor in overcoming substantial differences between people of physical and mental labor, between urban and rural areas. The universal development of education after the October Revolution was also one of the necessary prerequisites to effecting actual equality between men and women, between citizens of different nationalities. Raising the educational level, political consciousness and overall culture of the population has been an integral part of the cultural revolution implemented under the leadership of the CPSU.

Since the initial days of its existence, the socialist state has resolutely ended the monopoly of the exploiter classes in education and spiritual wealth. Full democratization of school education was implemented. All workers obtained access to the schools, regardless of their social position, nationality or creed. Broad access to the schools was provided by making education free and mandatory for all children and adolescents, by providing for freedom of choice of language of instruction, and by development of the network of academic institutions across the country. Instead of the former elitist system, a unified state system of education was created which was characterized by unity and continuity of all its types and grades and by the opportunity of transferring from lower grades to higher ones.

The following fact, in particular, testifies to the enormous attention paid the development of education and raising the cultural-technical level of the population by the Communist Party and by V. I. Lenin personally from the very first days of Soviet power: During 1917-1921, V. I. Lenin signed 192 decrees and resolutions on questions of public education and instruction of the masses. During that period, the Sovnarkom [Council of People's Commissars], chaired by V. I. Lenin, met 34 times to discuss questions of adult instruction.

The young Soviet state began carrying out the cultural revolution and developing public education under unbelievably difficult conditions of ruin and famine. "During those years," said Comrade L. I. Brezhnev, "we had to economize on everything, but the party and government allocated funds for the development of education, science and culture with a generosity which might be envied by even the richest capitalist countries.[1] And that far-sighted generosity, permeated with high responsibility for the welfare of the people, bore remarkable fruit: a cultural revolution unprecedented in its depth and scope was accomplished in an extremely brief time period. A gigantic leap from illiteracy and cultural backwardness of a majority of the population to the heights of modern education and culture was made in the lifespan of a single generation. By the mid-1930's, illiteracy had already become a thing of the past and primary school was mandatory. Incomplete seven- and eight-year secondary education was introduced in the late 1950's and early 1960's. In the Ninth Five-Year Plan, the transfer of young people

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1. L. I. Brezhnev "Leninskim kursom. Rechi i stat'i" [On a Leninist Course. Speeches and Articles], Vol 2, Moscow, 1970, p 89.

to universal secondary education was basically completed, which is testimony to the establishment of developed socialist society in out country. A state system of preschool education which is an integral part of public education has been created in our country, for the first time anywhere.

As is known, problems of education do not reduce to simply the training of children. An extensive network of general education schools for training working young people and adults has been created and is operating successfully in the USSR. A large-scale, highly efficient system of occupational-technical education has been created for training skilled worker personnel. The overwhelming majority of the higher and secondary special academic institutions from which the cadres of the socialist intelligentsia have come were created during the years of Soviet power. The few academic institutions which prepared highly-skilled and medium-skilled specialists prior to the October Revolution have changed beyond recognition during those years. "Socialism has given the workers the broadest possible access to knowledge and the riches of spiritual culture," states the CPSU Central Committee Decree 'On the 60th Anniversary of the Great October Socialist Revolution.' "In pre-revolutionary Russia, about three-fourths of the adult population was illiterate. Now, more than three-fourths of the workers employed in the national economy have a higher or secondary (full or incomplete) education. More than 93 million persons are now covered by all types of training."[1]

The highly developed system of education which has evolved in mature socialist society has received fundamental legislative registration in the draft of the new USSR Constitution. "USSR citizens," states Article 45 of the draft, "are entitled to an education. This right is ensured by the fact that all types of education are free, by carrying out mandatory universal secondary education of young people, by the broad development of occupational-technical, secondary special and higher education on a basis of links between training and life, production, by the development of correspondence and night schooling..., by the development of an occupational guidance system, and by the creation of conditions for worker self-education."[2] The achievements of the Soviet state in the field of education prove convincingly the advantages of socialism over capitalism. "History, the strictest teacher," said Comrade L. I. Brezhnev at the All-Union Teachers' Congress, "has set out country the topic 'public education -- the highest grade'."[3]

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1. "On the 60th Anniversary of the Great October Socialist Revolution" CPSU Central Committee Decree of 31 January 1977, Moscow, 1977, p 8.

2. "Proyekt Konstitutsii Soyuza Sovetskikh Sotsialisticheskikh Respublik" [Draft of the Union of Soviet Socialist Republics Constitution], Moscow, 1977, p 20.

3. L. I. Brezhnev "O kommunisticheskom vospitanii. Rechi i stat'i" [On Communist Education. Speeches and Articles], Moscow, 1974, p 171.

It does not follow from this, however, that there are no more serious tasks in the area of raising the cultural-technical level of the workers. Life itself is continuously posing such tasks and now, under conditions of developed socialism, when our country is directly facing the tasks of creating the material and technical base of communism on the basis of uniting the achievements of the scientific and technical revolution with the advantages of the socialist system of the national economy, they are very complex.

The scientific and technical revolution is characterized, in particular, by a reduction in the time involved in introducing scientific discoveries into industry and by substantial structural shifts in production. Thus, in the Ninth Five-Year Plan, as compared with the Eighth, the rates at which new types of output were mastered increased two-fold, and the rates at which obsolete technology was withdrawn from production increased three-fold. Work on modernizing equipment and improving product quality has been conducted on a broad scale. In recent years, the overall mechanization and automation of production processes, especially in branches which determine scientific and technical progress -- machine building, power engineering, chemistry, petrochemistry, and others -- has been carried out at significant rates. Whereas 99,000 mechanized flow lines and about 11,000 automated lines were installed in industry in 1971, these figures were 114,000 and 17,000, respectively. There is an obvious trend towards outstripping growth in the introduction of automated lines as compared with mechanized flow lines. The use of programmed-control machine tools in machine building is increasing rapidly.

All this is rapidly and substantially increasing demands as to work quality, and therefore, as to general education and occupational-skill worker training as well. Total and timely consideration and actualization of these demands is one of the most important socioeconomic tasks of developed socialist society.

Under the effect of overall mechanization and automation, the sphere of application of skilled labor is expanding and heavy, physical, unskilled labor is being eliminated; the process of combining mental and physical labor is being intensified. The share of creative, analytical functions in the labor activity of workers is increasing and the center of gravity is shifting from experience and "knack" to knowledge. Over a 20-year period, the general education level of industry workers has risen significantly, in connection with the higher scientific and technical level of industrial production (see Table 1 [page following]).

Now, nearly one in every three workers at industrial enterprises has a complete secondary education, and of those under 30 -- nearly half. In the leading branches of industry, those which determine scientific and technical progress, the percentage of young workers with a complete secondary or higher education is considerably higher, however. Thus, among workers under 30, the proportion having a complete secondary or higher education was 56.1 percent in power engineering, 61.5 percent in chemical and petrochemical industry, 67.1 percent in oil refining, and 54.4 percent in machine building.

Table 1. Distribution of Industry Workers, By Education,* in percent

	Все рабочие 1)	2) Из них имеют образование		
		полное среднее и высшее 3)	неполное среднее 4)	начальное 5)
1952 г. на 1 марта 6)	100	2,4	25,5	48,2
1973 г. на 1 июня: 7)				
8) все рабочие промышленности	100	29,7	41,2	26,7
9) в том числе в возрасте до 30 лет	100	50,5	43,5	5,9

Key:

1. all workers
2. with the following education
3. complete secondary or higher
4. incomplete secondary
5. primary
6. 1952 as of 1 March
7. 1973 as of 1 June
8. all industry workers
9. including those under 30

(*) "Narodnoye khozyaystvo SSSR v 1973 g." [USSR National Economy in 1973], Moscow, p 589.

As sociological research has shown, among workers with a secondary education, as compared with those having a primary or incomplete secondary education, the time involved in reaching high production results is two- to three-fold shorter. The rates at which occupational skills are mastered and the rates of skill growth are accelerated even more if a higher general education level is combined with appropriate occupational training. The results of our investigations of oil refinery industry workers can give a certain idea of the role simultaneous raising of the occupational and general educational levels of workers plays in accelerating skill growth (see Table 2).

Table 2. Average Annual Increment in Rate Category of Workers With Different Levels of General and Occupational Education

1) Формы профессионально-технического обучения	2) Уровень общего образования	
	неполное среднее 3)	4) полное среднее
5) Подготовка непосредственно на производстве	0,55	0,87
Профтехучилище 6)	0,82	0,93

Key:

1. forms of occupational-technical training
2. level of general education
3. incomplete secondary
4. complete secondary
5. training directly in production
6. occupational-technical school

As the research shows, workers with a higher level of education permit fewer defects and display greater creative activeness in the struggle to release high-quality output. Such workers emerge most often as the initiators of the movement to combine occupations, expand service zones and make more effective use of working time, and they are most often the leaders in socialist competition.

The data of Table 3 testify to the growth in the level of education and the level of mechanization of the labor of workers.

Table 3. Growth in Education Level and Worker Labor Mechanization Level From 1959 Through 1974

Годы 1)	Рабочие, имеющие высшее и среднее (неполное и полное) образование на 1000 человек* 2)	Рабочие, занятые механизированным трудом, включая труд наладчиков и ремонтников (в % к общей численности рабочих)** 3)
1959	396	45,5
1970	586	54,5
1974	679	56,9

Key:

1. years
2. workers with a higher or secondary (complete or incomplete) education, per 1,000 persons*
3. workers employed in mechanized labor, including adjusters and servicemen (percentage of total number of workers)**

(*) "Narodnoye khozyaystvo SSSR v 1973 g.," p 41.

(**) L. A. Kostin "Proizvoditel'nost' truda i tekhnicheskiy progress" [Labor Productivity and Technical Progress], Moscow, 1974, p 127.

Raising the general educational, cultural-technical level of the workers must actually outstrip production development to a certain extent. The level of general education and occupational training of the workers must be oriented towards new equipment and progressive technology. A definite reserve of education is necessary to adapt workers to rapidly changing production demands connected with technical progress. However, an extreme gap between educational level and the availability of equipment to labor has negative consequences, first of all because of worker dissatisfaction with the jobs being done.

At present, overall mechanization and automation of the entire production cycle, including subsidiary-auxiliary and loading-unloading work, have acquired priority importance in ensuring the necessary conformity of education to labor content. The level of mechanization of auxiliary jobs is considerably lower than that for basic jobs. Auxiliary jobs account for a significant proportion of the heavy physical and low-skill labor. "In working out economic plans for the future," Comrade L. I. Brezhnev emphasized, "we are consciously including in them such elements as will lead to automation and mechanization of production processes, to a reduction in the sphere of unskilled labor. The latter is very important, not so much from the viewpoint of its economic impact, but from the viewpoint of making working conditions easier and changing the very nature of the labor of millions of Soviet people."[1]

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1. L. I. Brezhnev "Leninskim kursom. Rechi i stat'i," Vol 2, p 115.

The necessity of raising the cultural-technical level of the workers under modern conditions results not only from economic development, but also from the requirements of social and cultural progress of mature socialist society. As we move towards communism, as the scope and complexity of the tasks facing society grow, so does the role of the subjective factor of the conscious, purposeful activity of the working masses. As the educational level of the working class rises, its leading role and influence on all aspects of life in Soviet society are strengthened. Our party proceeds systematically from Lenin's instruction: "...the greater and more responsible a new historical task is, the more people there must be, with millions being attracted to independent participation in resolving these tasks."[1]

Growth in the general educational and cultural-technical level of the workers now emerges more as a means of increasing their labor and social activeness than at any previous time. Development of socialist democracy and the broad participation of the workers in various forms of scientific-technical creativity are important factors in the comprehensive development of personality. It must be borne in mind also that the attraction of workers into management as a very responsible intellectual activity plays a special, specific "compensating" role for those who still perform uninteresting, monotonous, unskilled, unattractive types of labor.

The management of state and economic affairs demands not only organizational abilities and desires, but also knowledge in the areas of management science, economics and production planning. Therefore, great importance is currently being attached to the economic education of all workers. Economic knowledge is being viewed as a mandatory aspect of the modern worker's skill.

As the educational level of the workers grows, their opportunities for participating in scientific and technical creativity broaden: in the efficiency-proposal and inventors' movement, in organizing leading experience schools, in combined creative-cooperation brigades of workers and engineering-technical workers to introduce scientific and technical achievements into production, and so forth.

Calculations have shown the close connection between the workers' education level and the level of development of efficiency-proposal work by branch of industry. Thus, the dual correlation coefficient between education level and number of proposals received per 100 efficiency specialists was 0.83, but the dual coefficient between worker education level and proportion of efficiency specialists in their total number equalled 0.94. The calculation of dual correlation coefficients between young worker educational level (up to age 30) and degree of development of the efficiency-proposal movement showed a less close connection. The dual correlation coefficients were 0.44 and 0.53, respectively. This testifies to the fact that the creative opportunities of young workers under 30 who have a high level of education

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1. V. I. Lenin "Poln. sobr. soch.," Vol 36, p 446.

are still not being fully used at industrial enterprises.[1] One reason for this situation, in our view, is the lack of agreement encountered between the education and the level of occupational skill of young workers. Many young men and women now enter production upon graduation from secondary school without having a specialty or a skill. Many of them end up being forced to take low-skill jobs. On the other hand, in the jobs requiring high skill are many older-generation workers with a low level of education.

The bulk of the workers with a low level of education in skilled jobs are older workers with long employment records. Moreover, among the skilled workers are quite a few people under 35 with a low level of education. They include first of all graduates of mass-type occupational-technical schools who have not studied at night (shift) working-youth schools and have not obtained a complete secondary education.

In recent years, collective social development plans which include as one of their most important sections raising the cultural-technical level of workers have been worked out at many of the country's enterprises. During the course of carrying out social plan measures, there has been research on opportunities for worker educational and skill growth. Social organizations have strengthened their attention to questions of training workers at the enterprise. Commissions for assisting young working students are being created. The recording of young people who do not have a secondary education is also being organized; steps are being worked out and implemented to attracting them to working-youth schools. Working-youth school collectives are being assisted in recruiting and retaining the student contingent. At certain enterprises, positive experience has been accumulated in establishing direct ties between raising general education and obtaining the next skill rating. Thus, for example, at Leningrad enterprises (Svetlana and others) and at the Volkhovskiy Aluminum Plant imeni Kirov there is in effect a system for simultaneously raising the general educational and occupational levels of working young people, and every condition is being created to ensure that young workers who have raised their general educational level will be able to raise their skill rating and wages within a year.

In recent years, one effective form of training workers in the principles of socialist management and leading methods of labor, of enlisting them in socialist competition and in the movement for communist labor has become the schools of communist labor. They successfully facilitate communist education and further growth in the cultural-technical level of the workers.

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1. Specific sociological research conducted at enterprises of Sverdlovskaya and Chelyabinskaya oblasts and in Leningrad, Rostov and Tbilisi confirm the conclusion that the degree of participation by young people in efficiency improvement and invention is lower than among older workers (see: "Obshchestvo i molodezh'" [Youth and Society], Moscow, 1973, p 129; SOTSIOLOGICHESKIYE ISSLEDOVANIYA, No 1, 1974, p 71; "Trudovoye vospitaniye molodezhi" [Labor Education of Young People], Moscow, 1976, p 106).

A characteristic feature of the present stage is a strengthening of the link between the general education of young people and their preparation for labor, that is, their training in occupational-technical academic institutions and job placement in production.

The labor education of young people in the general educational schools has improved significantly. In the labor lessons, the reliance is on shaping among young men and women the desires and habits of work in the common physical labor occupations; they are taught respect for all types of labor activity. In initial occupational training of their pupils, rural general education schools have moved forward significantly. They have introduced training students to work with tractors, combines and other agricultural machinery, as well as with basic principles of agrotechnology and stock raising. The study-production brigades have become an effective form of the labor education of rural school students in the upper grades. Positive experience in organizing the production training on a broad polytechnical basis has also been accumulated in many urban secondary schools. Particularly well-recommended are the interschool labor training and occupational guidance study-production combines. In 1975, almost 200,000 students from more than 2,000 of the nation's secondary schools underwent labor training in them. In recent years, rayon interschool study-production combines have been organized. This has permitted the more effective use of expensive equipment, production premises and instruction personnel and has provided broader opportunities in the selection of occupational training and the better coordination of specific forms of labor education and training with production requirements. A noticeable shift has been planned in improving occupational guidance. However, the organization of this work still lags behind modern requirements.

The course towards providing young men and women with specialties prior to their going to work, which has already fully justified itself, is being conducted systematically. The occupational-technical schools, in which young people obtain an occupation and a secondary education, are already playing and will play an important role in implementing this course. In 1971-1975, 1.6 million persons were admitted to such occupational-technical schools, including 506,000 in 1975. During that period, the enrollment in these occupational-technical schools, which are viewed as the most promising for training skilled worker cadres, increased more than 10-fold. By 1980, admissions to occupational-technical schools providing a secondary education will have increased 1.8-fold over 1975. In the Tenth Five-Year Plan, the enrollment of students in technical schools for graduates of complete secondary schools is also being increased. In the current five-year plan, special attention is being paid to expanding the network of rural secondary occupational-technical schools. It is planned to allocate as much funds for their construction in the Tenth Five-Year Plan as were allocated in the Eighth and Ninth Five-Year Plans taken together. As many seats will be added to the rural occupational-technical school system in 1976-1980 as existed in it at the start of the Tenth Five-Year Plan.

Various forms of linking production collectives to schools and occupational-technical schools are being developed. The mentor [nastavnik] movement, whose

initiators are the leading production workers, has received extensive dissemination. One effective form of the labor breaking-in of young people entering production for the first time is the development and implementation at certain leading enterprises of individual occupational-skill growth plans for young production workers. Such plans outline mutual obligations of the young workers and the labor collectives. On the one hand, skill improvement and training, shifting from less to more substantive work, and so forth is planned in conformity with the interests of the young workers. On the other, the collective assumes the obligations which will assist in carrying out these plans on the condition that the young workers have an intelligent attitude towards their own labor obligations. Also meriting dissemination is the experience of planned regulation of the process of moving workers to skilled jobs and the compilation of plans for skill improvement which has been accumulated at such plants as the Volga Motor Vehicle Plant, the Dinamo Electrical Machine Building Plant imeni Kirov in Moscow, the Dneprospetsstal' Plant imeni Kuz'min in Zaporozh'ye, and others.

Political education plays an important role in ideological-educational work. About 20 million persons, including more than seven million nonparty people, are now being trained in the party education system. A most important feature of contemporary development of social consciousness is the mastering of Marxist-Leninist theory by the masses of workers. Increasingly broad masses of workers are being attracted into party studies with each passing year, and the effectiveness of ideological-education work is increasing.

At the present stage, further growth in the culture and development of the education of workers are becoming important factors in improving the social structure of Soviet society, in reducing differences between people of physical labor and those of mental labor, between urban and rural areas. In recent years, the process of bringing the levels of education of workers and kolkhoz members closer to each other has been accelerated and, as a result, the social homogeneity of our society has been significantly strengthened.

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CONCLUSION OF REGULATIONS ON NEW BONUS PAYMENT PROCEDURE REPORTED

Moscow EKONOMICHESKAYA GAZETA in Russian No 48, Nov 77 p 22

/Article: "New Procedure for Making Bonus Payments"/

/Text/ The USSR State Committee for Labor and Wages and the Presidium of the All-Union Central Council of Trade Unions have confirmed the Basic Regulations on Paying Bonuses to the Employees of Industrial Production Associations (Combines) and Enterprises for the basic results of economic activity. Preceding editions of the weekly have carried three sections: "General Principles," "Bonus Payments for Workers," and "Bonus Payments for Managerial and Engineering and Technical Personnel and Employees." Today we publish the last section of the Basic Principles and the addenda to them. (Conclusion. Regulations were begun in Nos 45-47)

IV. Procedure for Reckoning and Approving the Payment of Bonuses and for Elaborating Principles on the Payment of Bonuses

4.1 The basis for reckoning bonuses is:

For managerial and management staff employees of the production association (combine) and the enterprise, data of accounting and statistical reports and on indicators unenvisioned by accounting and statistical reports and data of current operation records and laboratory monitoring;

For employees of production units, services, shops, and sections, data of accounting reports, current operation records, and laboratory control.

4.2 Bonuses are reckoned for actually worked time:

For workers, on the basis of earnings in accordance with piece or wage rates (salaries). The procedure for reckoning bonuses is set by the head of a

production association (combine) and an enterprise in agreement with the trade union committee;

For managerial and engineering and technical personnel and for employees, on the basis of post salaries. For specialists for whom salaries are set in accordance with No 21 of the 24 September 1968, No 760, decree of the CPSU CC and USSR Council of Ministers, the amounts of bonuses are reckoned by proceeding from the maximum salary of the appropriate employee not having an academic degree.

The bonuses of workers, engineering and technical personnel, and of employees are also reckoned on the basis of the additional payments to the wage rate or to the post salary that are paid in accordance with in-force legislation for multiple job holding, for the expansion of service zones or an increase in the amount of work, for the performance of the work of an absent worker, for the release of personnel at serviced sections and the raising of labor productivity over the planned level on the basis of realizing elaborated organizational and technical measures, and for nighttime work.

For holiday work and for overtime, bonuses are reckoned on the basis of earnings in line with ordinary piece rates or with the ordinary wage rate or salary.

For employees who have not worked a full month (quarter, season) in connection with their induction into the USSR Armed Forces, transfer to other work, entrance into an educational institution, shift to a pension, release on the basis of staff reduction, and other valid reasons, the payment of bonuses is effected for actually worked time in the given report period.

For employees who are newcomers to the job, bonuses for worked time in the first month (quarter) of work may be paid at the discretion of the head of the production association (combine), production unit, or enterprise.

4.3 Bonus payments from the material incentive fund are effected in the following order. Bonus for workers from the material incentive fund are paid within the limits of the part of the assets of this fund that are set aside on an estimated basis for paying bonuses to workers, and the bonuses of managerial and engineering and technical personnel and of employees are paid within the limits of the part of the assets that are set aside for paying bonuses to these employees.

For paying bonuses to employees on the basis of the results of the first and second months of every quarter, it is possible to make advance deductions from profit for the material incentive fund. These deductions are set in amounts insuring the payment of bonuses reckoned for employees.

Bonus payments based on work results for the third month of every quarter are effected within the limits of the residual of the bonus assets of the material incentive fund, which is computed in line with the operational indicators of

the production association (combine) and the enterprise as a running total from the beginning of the year. This being the case, what is excluded from the aforementioned residual is the sum of the bonuses not paid to managerial and engineering and technical personnel and to employees in connection with the overexpenditure of the wage fund and with the nonfulfillment of plan indicators in preceding periods.

4.4 Bonuses are approved:

For workers, by the head of the association's (combine's) production unit and the enterprise or by the shop (production) chief at the representation of the foreman, unit chief, or other official heading up a production section;

For managerial employees of the production association (combine) and the enterprise, by the head of a higher-standing organization;

For the remaining engineering and technical personnel and employees, by the head of the appropriate production association (combine) and the enterprise and production unit.

This being the case, the bonus reckoned for an employee may be increased or reduced in agreement with the appropriate trade union committee, but by no more than 25 percent, with due regard for work quality and the employee's personal contribution to overall results.

4.5 Bonuses for the period under review (month, quarter, season) must be paid to employees generally no later than a month following the end of the period under review.

4.6 Employees guilty of violating production and technological instructions, sectoral demands as to safety measures, and other production oversights may be wholly or partially deprived of bonuses for fulfilling and overfulfilling the set indicators of bonus payments. The list of production oversights is set by the head of the production association (combine), production unit, and enterprise in agreement with the trade union committee.

In cases of the return to production associations (combines) and to enterprises of consumer goods because of their low quality, the employees guilty of the production of such goods (their manufacture, quality control, and sale to customers) may be wholly or partially deprived of bonuses for fulfilling or overfulfilling the set indicators of bonus payments.

In cases of the institution of administrative or criminal proceedings for hooliganism and drunkenness and of the application of the publicly influencing measures envisioned by the 26 July 1966 ukaze of the USSR Supreme Soviet's Presidium and by the ukazes of the union republic Supreme Soviets' Presidia may be wholly or partially deprived of bonuses.

Individuals who absent themselves from work are wholly or partially deprived of bonuses.

Employees of various categories may be wholly or partially deprived of bonuses in accordance with the list presented in addendum No 2 to the Basic Principles.

4.7 Whole or partial deprivation of bonuses is effected for that settlement period in which the work oversight was committed and is drawn up by an order (a regulation) of the head of the production association (combine), the enterprise, or the higher-standing organization, with the obligatory showing of the reasons for the deprivation.

The right to solve the problem of workers' whole or partial deprivation of bonuses is also granted to the chief of the shop (appropriate structural subdivision).

The deprivation or reduction in the amount of bonuses for workers is effected at the representation of the foreman or other official heading up the production section.

In case of the revelation of cases of the manufacture (sale) of poor-quality products, the managerial and engineering and technical personnel and employees permitting their manufacture (sale) are deprived of bonuses for those months or quarters when these cases are revealed, irrespective of whether these employees are brought to disciplinary or other types of responsibility in the established order.

In case of the presence of cases of accounts juggling and distortion, of hooliganism and drunkenness, deprivation or reduction in the amounts of bonuses is effected in that settlement period in which these violations were revealed or reports on them received.

4.8 In accordance with the Model Regulation or Bonus Payments approved by the ministry (agency) together with the central (republic) trade union committee, the head of the production association (combine) and the enterprise approves in agreement with the trade union committee the regulations on bonus payments for employees of the production association (combine) and the enterprise. The group of bonus-receiving employees is set annually when the annual production plan and material incentive fund for the current year are approved and when the collective contract is accepted.

As to the coming into force of the regulations on bonus payments and as to changes in them or their revocation, the employees of the production association (combine) and the enterprise are given no less than 2-weeks notice.

4.9 The heads of production associations (combines) and of enterprises together with trade union committees are instructed, on the basis of the Model Regulations on Bonus Payments elaborated by ministries and agencies, to continuously improve the extant bonus payment system, with a view toward insuring the requisite material interest of every employee and collective as a whole in accepting and fulfilling stepped-up plans, increasing labor productivity, economizing on material resources, cutting output costs, incorporating the production of new items, producing high-quality goods in the set mix, as well as accomplishing assignments and obligations on product deliveries.

4.10 Ministries and agencies together with central and republic trade union committees are instructed to systematically study, generalize, and disseminate advanced experience in the area of bonus payments in subordinate production associations (combines) and at enterprises, to take measures to tighten control over the use of the funds allocated for material incentives, to be more exacting toward enterprise heads and trade union committees as to the use of incentive funds, and to institute proceedings against persons violating the established bonus payment order.

Addendum No 1

List of the Positions of Production-Association (combine) and of Enterprise Employees for Whom Bonuses Are Reduced in Connection With the Permitted Overexpenditure of the Wage Fund.

1. General directors, directors, managers, chiefs, heads, and other leaders of production associations (combines), of enterprises and production units, their deputies and assistants, and chief engineers and their deputies.
2. Division chiefs and their deputies.
3. Works chiefs and their deputies.
4. Chief specialists.
5. Chief accountants (senior accountants with the rights of chief accountants) and their deputies.
6. Chiefs of shops (oil fields, factories, timber-extracting stations, detachments, expeditions, and other subunits operating with the rights of shops) and their deputies.
7. Chiefs of labor and wage offices in shops; in case of the lack of such an office, individuals handling labor and wage problems.
8. Chiefs of planning and planning and allocation offices in shops; in case of their lack, individuals handling planning problems.
9. Senior shop bookkeepers.
10. Senior shop mechanics and senior shop electricians; in case of their lack, shop mechanics and electricians.
11. Heads of works of nonbasic production that are not singled out for operating on an independent budget and do not form part of production units.

Addendum No 2

List of Violations Whereby, According to In-Force Legislation, Bonuses Reckoned for the Basic Results of Economic Activity for Various Categories of Employees Are Reduced or Not Paid at All.

According to in-force legislation, bonuses reckoned for the basic results of economic activity are reduced or not paid at all to various categories of employees guilty of the following violations:

The nonfulfillment of calendar norm-reconsideration plans envisioned in collective contracts on management obligations on reducing the normed labor

intensiveness of articles (work) and on raising the level of norm setting and labor productivity;

The nonfulfillment of the plan for commissioning production capacities and construction objects;

The nonaccomplishment of assignments on ferrous metal economies;

The nonfulfillment of plans for planning and constructing enterprises and objects on the basis of compensation agreements and the belated delivery of equipment and other items for these objects;

The nonfulfillment at the set time of measures to prevent the pollution of fish-breeding water bodies and of plans for the amount of construction and installation work on treatment facilities;

Exceeding the standard idling time of Railway Ministry freight cars;

The formation of overdue penalty-accruing indebtedness;

Accounts juggling and distortion;

The illegal issuance of orders for the planning of the administrative buildings of spectator enterprises, of stadia, and other analogous objects;

The submission to pricing organs of wholesale and retail draft prices with deliberately overstated production outlays;

The submission or the payment of commodityless settlement documents.

Procedures for Applying the Basic Regulations at Enterprises not Shifted to the New System for Planning and Economically Promoting Production

The organization of bonus payments for employees of enterprises not shifted to the new system of planning and economic incentives is effected in accordance with the Basic Regulations, with the following features:

1. Bonuses for managerial and engineering and technical personnel and for employees for basic results of economic activity are paid only at the expense and within the limits of the enterprise's wage fund.

   The bonuses of workers are paid at the expense of the wage fund, and the bonuses are paid irrespective of the status of its consumption by section, shop, works, or enterprise.

2. The total bonuses paid to one managerial and engineering and technical personnel and employee for basic results of economic activity from the wage fund should not exceed the set amount.

The general maximum sum of the bonuses based on special systems for bonus payments and one-time rewards for the fulfillment of especially important production assignments paid to one managerial employee of the enterprise should not exceed the set amount.

3. In case of the overexpenditure of the wage fund, the enterprise's managerial employees are deprived of bonuses until it is replaced. The unmade-up part of the sum of the wage fund overexpenditure is charged to the enterprise for a year, starting from the time of the appearance of the overexpenditure.

   If the enterprise replaces the permitted wage fund overexpenditure before 6 months, the aforementioned employees are paid 50 percent of that part of the bonus which was not paid in the preceding periods because of wage fund overexpenditure.

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LABOR RESOURCES IN NON-BLACK EARTH REGION

Moscow SEL'SKAYA ZHIZN' in Russian 25 Nov 77 p 2

[Article by A. Maykov, first deputy chairman of the State Committee on Labor of the RSFSR Council of Ministers: "Labor Resources in Rural Area"]

[Text] The resolution of the CC CPSU and USSR Council of Ministers, "Concerning Measures for the Continued Development of Agriculture in the Non-Black Earth Region of the RSFSR," initiates a complex program for intensifying kolkhoz-sovkhoz production and for transforming the social appearance of the village in this region of the country. One of the most important factors in solving the set task is the efficient utilization of labor resources, as well as the improvement of the regiment for the renewal of the labor force. The problem is that in the Non-Black Earth Region an unfavorable demographic situation is developing and a shortage of cadres is being felt. Their shortage is most acutely felt in agriculture in this zone.

For this reason it is important to strengthen attention to problems of securing and raising the training of cadres involved in agricultural production. Of great significance for finding a solution to this problem is the recent CC CPSU and USSR Council of Ministers resolution, "On Additional Measures to Stimulate the Transition of Agricultural Specialists to Jobs as Leaders of Departments, Brigades, Farms and Other Subdivisions of the Central Production Links in Kolkhozes and Sovkhozes." The realization of the planned program will undoubtedly allow us to secure important areas of agricultural production with qualified cadres.

In connection with this, it is essential to pay greater attention to questions of retaining young people in the village. The initiative of graduates of secondary general schools in Kostromskaya Oblast, who have decided to tie their fate with the noble calling of grain farmer, livestock farmer or builder should be made more widespread. In 1977 in all oblasts of the autonomous republics of the Non-Black Earth Region there were meetings for tenth graders. Following the example of Kostromskaya students, about 40,000 graduates of rural schools in Gor'kovskaya, Kirovskaya, Yaroslavskaya and other oblasts have begun work in kolkhozes and sovkhozes.

Work with youth at the Kolkhoz imeni Kalinin, Zelenogradskiy Rayon, Kaliningradskaya Oblast has proved to be very interesting. This farm issued equipment for the Romanovskaya Secondary School and organized courses for upperclassmen for training as machine operators and livestock farmers. A study-consultation station was opened for participants. Graduates of 10-year courses and SPTU [expansion unknown] receive an average increase in wages of 15 percent. During the last 3 years 16 young families have been issued housing without having to wait their turn. Loans that do not have to be repaid have been issued. A kindergarten for 90 children has been built in the village and a House of Culture is being equipped.

The creation of komsomol-youth collectives is a widespread practice in this kolkhoz. It is there that the most favorable conditions develop for acquiring practical skills and for developing one's personality. In particular, the number 2 komsomol-youth farm is well-known. It received first place in the oblast for wintering livestock and received an honorary certificate from the CC VLKSM. In 1977 graduates of the local school decided to go to work at the livestock complex in the kolkhoz.

In the country there is an increase in the number of pensioners because of increased longevity and changes in the age structure of the population. For this reason, the use of their labor in public production is of great importance for agriculture. Of course, to solve this task, certain organizational efforts must be made. The moral and material interest of retirees in participating in public production must be increased. Shortened work weeks and days must be made available to these people.

One of the important conditions for the economic development of the Non-Black Earth Region is decreasing the migration of the population from the village. In order to work out ways to regulate the migration of the population it is essential to more actively utilize existing test results. They show that enlarging settlements is of great significance for the creation of permanent agricultural cadres.

In the future it is planned to resettle 170,000 families voluntarily in comfortable kolkhoz and sovkhoz settlements of oblasts and autonomous republics in the zone. At the present time this type of work is actively being done in Vologodskaya, Pskovskaya, Novgorodskaya, Kirovskaya and some other oblasts of the Non-Black Earth Region. As practical experience shows, when this approach is used, a successful solution to the problem of securing a work force is reached. Here are some examples.

In the Put' Lenina Kolkhoz of Kotel'nicheskiy Rayon, Kirovskaya Oblast, 48 villages were settled collectively. As a result, the basic labor force was located closer to the areas of production. Cultural-everyday conditions of work and living improved. Sowing areas increased by over 500 hectares when additional lands could be plowed where small villages were once located. Whereas in 1970 879 people lived in the kolkhoz and 358 of these were able to work, having an average age of 50 years, in 1976 the population of the

enterprise numbered 1,100 people, with over 500 capable of working and with an average age of 37. During the last 5 years the birth rate here has tripled. The number of school participants has increased from 86 to 200. An evening school has been opened for those students who were not able to receive a secondary education earlier, for whatever reasons.

It has become a tradition in this kolkhoz to throw going-away parties for men who have been called up to serve in the Soviet Army. During the term of duty, the kolkhoz administration, party committee and komsomol organization maintain constant ties with the soldier. Young married people are provided with comfortable apartments. In order to secure cadres within all areas of the kolkhoz, supplementary wages are paid annually according to length of work. As a result of taking such measures, a tendency towards moving back into the village has been observed.

In order to successfully realize the program of enlarging settlements, in future settlements it is essential to accelerate the designing of rayon and general building areas in central areas of kolkhozes and sovkhozes, to consistently expand the building base, to proceed with complex building in the village while taking into account the development of enterprises and cultural-everyday service institutions of the transportation network as well as with other conveniences.

In attempting the stabilization of rural labor collectives, it is important to concern ourselves primarily with cadres to operate machinery. This is the leading category of agricultural workers. One of the reasons for the shortage of machine operators is imperfections in labor organization. Another is the underrating of measures of material incentives and stimulation for the fulfillment and overfulfillment of shift tasks in the best agrotechnical time. On many kolkhozes and sovkhozes there are still violations of resolutions concerning wages. In particular, bonuses are not always paid when there are savings in direct expenditures and when work is completed with good quality and on schedule.

On a number of farms output norms for young machine operators do not decrease in the size planned by state resolutions. On many farms agricultural equipment remains idle for long periods of time because of the absence of well-equipped shops. All of this decreases the wages of machine operators, especially of SPTU graduates, and serves as a reason for their leaving the village. Practical experience shows that in those places where concern is shown for young machine operators, stable collectives develop. Thus, in Nebylovskiy, KIM and Krasnosel'skiy sovkhozes and in the Rossiya Kolkhoz of Vladimirskaya Oblast young machine operators usually are issued equipment that is in good order and teachers are assigned to them. SPTU graduates and school graduates are given privileges in wage payments. Young married people are issued comfortable housing.

The solution to the problem of securing agriculture in the Non-Black Earth Region of the RSFSR with cadres depends to a great extent on how much

corresponding internal reserves will be utilized. Under these conditions the proper organization of accounts of labor resources is of great importance. Unfortunately, this work still does not correspond to the five-year plan task in effectiveness and quality. Accounts are still not compiled according to cities, rayons and professions. Through the efforts of the State Committee on Labor on the RSFSR Council of Ministers, accounts of kolkhoz and sovkhoz labor supplies are being compiled. However, even here the organization of this work requires improvements.

In order to raise the effectiveness of using labor resources in the Non-Black Earth Region, the work experience of local soviets of workers' deputies in Moscow Oblast should be widely assimilated. Here a clear system of work organization and planning on labor resources has been created in conjunction with a complex plan approved by a joint decision of the CPSU obkom and oblispolkom. Permanent deputies committees on labor have been created in all city and rayon soviets to deal with a wide range of problems related to studying the formation and use of labor resources and providing a labor structure for the population. Special attention is given to seeking out and recruiting youth for agricultural production.

The experience of Moscow Oblast is being widely applied in the Non-Black Earth Region. In all oblasts and autonomous republics concrete proposals have been worked out and confirmed by councils of ministers of autonomous republics and oblispolkoms directed at improving organizational and economic work to seek out, secure and efficiently utilize labor resources. In 18 oblasts and autonomous republics in the zone permanent deputies' committees, public soviets and labor departments have been created and are in operation. The activities are based on complex plans that were preliminarily examined and confirmed at sessions of the soviets of people's deputies.

Now it is important to unify the efforts of state, scientific and economic organs, directing them to solve problems on the efficient utilization of labor resources in the Non-Black Earth Region. This is the key to the successful completion of a program for the continued development of the economy and of culture in the largest region of the country.

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SKILL IMPROVEMENT URGED FOR ESTONIAN AGRICULTURE WORKERS

Tallin SOVETSKAYA ESTONIYA in Russian 2 Nov 77 p 3

[Article: "In the Agriculture Commission of the Estonian SSR Supreme Soviet"]

[Text] "Quite a lot has been done in recent years to reinforce agriculture with skilled cadres," said Comrade L. I. Brezhnev in the Accountability Report to the 25th CPSU Congress. In our republic, the system of training and retraining agricultural personnel basically meets modern requirements. However, constant growth in labor and production efficiency in agriculture assumes further improvement in cadre skill. Proceeding from this, the Agriculture Commission of the Estonian SSR Supreme Soviet examined the state of improving agriculture worker skills in light of the tasks set by the 25th CPSU Congress at its meeting. Giving reports were E. Aava, Estonian SSR Deputy Minister of Agriculture, and V. Kozlov, rector of the Estonian Agricultural Academy.

The commission noted that more than half the kolkhoz and sovkhoz workers in our republic are certified. The role of the schools of leading experience and the people's universities of agricultural knowledge in improving cadre skills has increased.

Estonian SSR Supreme Soviet deputies V. Udam, U. Tinits, Kh. Paal', A. Pyldroo and Z. Ivanova, in analyzing the state of affairs with regard to improving agriculture worker skills locally, focused attention on existing shortcomings. Thus, the ispolkoms of Khiyumaaskiy, Vyruskiy, Khar'yuskiy and Kingiseppskiy rayon Soviets of People's Deputies and their agriculture administrations have concerned themselves little with questions of certifying plant-growing and stock-raising workers, as well as tractor operators. Few specialists with a higher education are sent to courses.

Also speaking at the meeting were E. Alas, first deputy chairman of the Estonian SSR Council of Ministers' State Committee for Occupational and Technical Education, and Yu. Kriys, deputy chairman of the Estsel'khoztekhnika Association.

Steps were outlined for raising the skill of agricultural cadres so that a majority of the tractor operators will have a I or II [wage-category] rating

by the end of the current five-year plan and all milkmaids, herdswomen looking after young stock, poultry and pig tenders [female] will be certified and will have acquired an occupation.

The commission recommended that the Estonian SSR Ministry of Agriculture and the ispolkoms of the rayon Soviets of People's Deputies ensure the planned and timely enrollment of laborers in skill-improvement courses for agriculture workers and that they strengthen the material and technical base of the schools of leading experience. It was also recommended that the possibility be examined of creating a republic study combine, attached to the Estonian SSR Ministry of Agriculture, for training skilled workers.

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BRIEFS

TURKMEN PEOPLE'S UNIVERSITY--A rural people's university of literature and art, the first in the republic, has been created on the Kolkhoz imeni Makhtumkuli. It was organized by the Institute of Language and Literature of the Turkmen Academy of Sciences and the rayon division of the Znaniye society. The program of the 3-year course of instruction includes familiarization of rural laborers with the cultural achievements of the Turkmen people. Prominent writers and poets, activists in the theater and films, artists and composers will be guests of the rural laborers. [Text] [Moscow TRUD in Russian 24 Nov 77 p 1] 11052

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